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VARIOLA:

ITS

CAUSES, NATURE *and* PROPHYLAXIS,

— AND THE —

DANGERS OF VACCINATION.

By C. SPINZIG, M. D.

(Literary revision by WM. T. HARRIS, *Sup't of the Public Schools of St. Louis.*)

(EXPLANATORY NOTE.—This Treatise is to some extent a republication of an Essay, published in 1870, as the report of a committee on the subject small-pox; but what is here retained of the original is scarcely more than the frame-work.)

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INTRODUCTORY REMARKS.

The subject of small-pox, since time immemorial, has elicited profound attention, both on the part of the profession and on that of the laymen. The views entertained, with regard to its causes and nature, have been and are yet seriously conflicting. With few only have they been founded upon the achievements and revelations of recent scientific research, and upon the general laws in nature that govern the organic as well as the inorganic world. Though by far the greatest majority have founded them upon maxims, generally denominated philosophical convictions, for which, however, the support of probability could be adduced only by forcing science into speculations infected with self-gratification, mystification and arbitrariness; or upon a prevailing tendency, which is coupled with interested motives, and to which is given so much of brilliant polish by dialectic versatility and interpolated statistical data, that taste and fashion, convenience and custom have enacted the law which demands unhesitating allegiance to the accepted theory. In harmony with the precepts deduced from the basis upon which the majority are guided, (i.e., the basis of error and deception) the "dogma" of "specific infection" has been introduced, and is received and hailed as the ultima ratio in explanation of the occurrence of epidemic diseases, notwithstanding that it proves as grand an illusion before the focus of scientific scrutiny as its irregularity of reaction proves contradictory to the potency of its ascribed virtue.

Writers on the subject of smallpox, therefore, must be classified into two grand divisions, according to the fundamental views they entertain with reference to the causation of epidemic diseases, viz: first that class by whom only an improper sensitiveness to physical influences is recognized in the production of disease, or who hold that the "specific" character of such influences determine the "specific" nature of disease. Consequently the phenomenon—small-pox—is held by this class to be but an outward manifestation of the process of interchange of material in the human organism, assuming form or characteristics pursuant to special physico-histo-chemical activities

therein engaged. The second class or division comprises the faithful *believers* in the "dogma" of "specific infection," and pursuant to which small-pox could only be produced and spread by the conveyance of a "specific contagious-infectious poison," from person to person, against which the general prophylaxis was to be found in "disinfection" and the susceptibility to infection was to be extinguished by "vaccination," "re-vaccination" and repeated vaccination.¹ In support of the views entertained by the first-named class of writers or investigators, abundant proof of irrefutable potency has now been gathered, by which the tenability of the doctrine of the "specific" and "infectious" nature of variola will not only be placed in doubt, but will directly be disproved; so also the admissibility of those measures, designated "prophylactic," insisted on in conformity with that doctrine.

With the progress of science or positive knowledge derived from modern investigation, unreasoning faith, miracles and mysteries must retire from the theatre of the operations of nature and be confined within the sphere of conceit and ultimately be buried in oblivion.

Upon a solid foundation the doctrine of evolution, gradual development and transmutation have set forth the evidence that there is nothing "specific," strictly speaking,² upon the earth's surface; everything being subjected to variations, characterized by the nature of physical influences, and that healthful or physiological activities may thus be converted into morbid processes, which assume type and form according, also, to the nature of external influences bearing upon the individual.³

(1) Yet in defiance of these artificial "efficient (?) preventive means," common logics in this wonderful philosophy have demanded the introduction of "immunity" and "exceptions to rules."

(2) From whence the small-pox poison originates, and what it is, no infectionist knows. In reference to it, the same inability of comprehension is manifest as was the case in ancient times with reference to the wind, expressed by the proverb "From whence the wind comes and whither it goes is not known." But since the barometrical minimum is understood and laws of storms are recognized and comprehended, the fact is now clear that there is no specific North, East, South or West wind; nor any specific storm-wind; that the wind comes from the colder and more condensed periphery of the storm-centre, and goes to the warmer and more rarified section for equalization.

(3) This view is well illustrated by the fact that "acclimatization" is essential for every individual, whether man, animal or plant (with apparent exception of the condor), to enable it to bear a change of climate. Also the changes as to type in the animal world, exhibit a parallel variation corresponding to latitude; from the robust Malay of the equatorial region to the dwarfed Samoeds of the polar region. In the world of vegetation they are even more characteristically exemplified, from the giant trees from the region of the equator to the mere moss vegetation of the snow line.

Comp. Humboldt, Kosmos, Vol. II, p. 30, et seq.

Berghaus, Physischer Atlas.

Griesebach, Die Vegetation der Erde, Vol. I, p. 76, et seq.

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Armand, Climatologie generale du Globe, pp. 69, 76.

Based upon these general and fundamental laws the author has ventured in this treatise to attempt the explanation of the physical causation of the phenomenon small-pox, and to prove that it is dependent upon the action of the same laws common to all other phenomena in the universe. It may then be proper in this place to allude to the main points that form the subject of this essay, and which are to be maintained and supported by corroborating evidence. They are the following:

1. Variola is dependent upon general causes, common to other diseases,¹ and as an epidemic is dependent upon meteorological variations, irregular at the locality and season.

2. The eruptive characteristics, by which variola is recognized, are but transitory phenomena, and are necessitated (fixed) resultants of the operations of physical laws.

3. The doctrine of "specific infection" cannot be supported, and "contagion"² is only possible by actual inoculation with small-pox pus, the effects of which do not differ from those produced by inoculation with other decayed animal matter.

4. "Vaccination" is tantamount to "inoculation"³ and constitutes *septica poisoning*—a criminal offence to human health and life—and is statistically proved to afford no protective or mitigating power over small-pox, and scientifically, in the nature of the case, it can not possess any.

5. Prophylaxis and amelioration are only to be found in sanitary measures that promote health in general.

In order to set forth each of these points or propositions in its general connection, it may appear expedient also to enumerate the subdivisions, of which the main essay in this treatise is composed. In this manner it will at once be seen under what subdivision or "head" any one of the foregoing points or propositions will be treated in detail. The chief subdivisions or "heads" will be as follows: Causes, Nature, and Prophylaxis, which will give ample opportunity for considering under the head: Causes, the first proposition; under that of Nature, the second and third; under Prophylaxis, the fourth and fifth; for causes embrace pathogenesis, aetiology, and *genius epidemicus*; "Nature," morbid anatomy and histochemistry; "Prophylaxis," hygiene and the presumptive value of vaccination, its injuries to health and dangers to life; and, finally, a sketch of its treatment.

(1) Comp. Oesterlen, *Seuchen*, p. 66.

(2) For definition of infection and contagion, comp. Pettenkofer, *Cholera-Frage*, 1873, p. 3. Also supplement to *Conversations-Lexicon*, 11th Ed., Brockhaus, Leip. 1873, Vol. II, Art. "Infectionskrankheiten."

(3) Comp. Coze et Feltz, p. 179.

CAUSES.

PATHOGENESIS AND ÆTIOLOGY.

In the effort to solve the problem: what are the causes and what is the nature of small-pox? the great majority of writers are perfectly contented with a maxim of implicit faith, viz: that of "infection" by a mysterious entity = "X," instead of recognizing the majesty and omnipotency of physical laws and their reaction—to which man is no exception. Moreover that owing to the "poisonous effects" of this miraculous X, the system is said to manifest outward signs, and by their peculiarity—"specific character"—their classification is decided, and accordingly a nosological appellation affixed. With few exceptions¹ no other method of inquiry is attempted outside of the customary—the "historical" or rather the empirical—one, and notwithstanding its utter unfitness and uselessness, now being fully and plainly proved, it is clamorously adhered to by the savants (?) of the profession.

Wonderful, indeed, are the logical (?) inferences deduced from that theory, upon the premises of the autogenous and automatical properties of the "infectious contagion;" e.g., asserting that with rigorous exertion of police power, viz: by means of military cordons, quarantine restrictions, dislodgment, disinfection and vaccination, the *Deus mala fide* of variola can be efficiently governed, (truthfully speaking, man is but tyrannized over) its "invasion" prevented, its progress restricted, its malignity mitigated, and its existence extinguished! Furthermore, upon this pretext the justification is based for arbitrary and unjust legislation, such as the compulsory vaccination acts of England, the German Empire, &c.,² or other vexations such as are embodied in the city ordinance, 10,615 of this place, approved Feb. 19, 1878.

With illy concealed intention tending to aid and support the compulsory vaccination act, it is said with absolute positiveness: "Small-pox is spread, at the present time, exclusively by means

(1) Of the publications on small-pox on this continent, there has BUT ONE come to my notice, i.e., Dr. Carl Both's treatise on small-pox and vaccination, in which the effort is made to elucidate the natural causes of the disease and its nature, and in contrast with which the practice of "vaccination" stands like fancy versus reality.

(2) Comp. Baake's *Vacc. Acts*; Curschmann, vide Ziemssen *Cycl.*, London *Lancet*, 1877. *Wilhelmi, Blattern u. Schutzimpfung. Pissin, Schutzpocken-Impfung. Monteils, Histoire de la Vacc.*

of a specific virus."¹ But upon following up this assertion it was found requisite to acknowledge: "Of the nature of small-pox contagion, there is, so far, nothing definitely known."

Canstatt as well as Niemeyer were more prudent in their assertions; Canstatt² gives his opinion with a great deal of reservation; he says: "From the *effects* of the specific agencies, producing the various exanthematic processes, their nature may be judged." Niemeyer³ has simply horrified from this sentence, when saying: "The small-pox poison is but known to us by its effects." However, not being unmindful of the object in view, this apparently modest reservation will not conceal the aim, namely: in the BELIEF of specific infection must be confided the solution of the origin and spreading of variola, and its course is to be regulated or determined by municipal ordinances. With special caution it is therefore said: "Assumption (!) may attempt to construe more from an inadequate material of observation (?) than would seem justified by the recorded and accessible totality of phenomena."⁴

This mode of argumentation could be indulged in as long as exacter means of investigation were not so generally in use, but now by means of minuter microscopic and more delicate chemical tests, by means of spectroscopic analysis in conjunction with the inferences derived from more precise and universally made physical (meteorological) observations, physiological facts are now ascertained with far more accuracy, and if they are applied in connection with pathological facts, established in the study of the phenomenon of inflammation, to the composition and physical deportment of the circulating fluids in the human organism, certainly no longer would it be warrantable to plead ignorant, for the material involved in the morphological phenomenon—small-pox, can now fairly be demonstrated, both in its chemico-synthetic and physico-morphological characteristics or behavior, as their reactions are fixed under physical or general influences of special (specific) combination.⁵

Specific "infection" or "contagion" has been proclaimed as not being subject to the laws of nature, as to it the power of self-

(1) Curschmann, vide Ziemssen Cycl. II, p. 333.

(2) Specielle Pathologie, 2d Ed., Vol. II, p. 16.

(3) Specielle Pathologie, 6th Ed., Vol. II, p. 542.

(4) Canstatt, l.c., p. 9. NOTE.—The accessible records of small-pox embracing a space of time more than a century, would they not be sufficiently extensive to invalidate the adjective "inadequate?" And would it not now appear contradictory to regard our present state of physiological, histo-chemical, natural-historical, and physical knowledge inadequate rationally to explain the phenomenon "small-pox, outside the realm of hypothesis?"

(5) Comp. Gottschall, Keine Impfung mehr, p. 6.

determination is ascribed, and from this gross delusion the propagation or spreading of small-pox, is, with shrewd eloquence, heralded all over the globe. Pursuant to this diametrical antagonism to science, and nature's great laws, it is asserted, with an air of cynical indifference, that the "contagion" rests in the variola pustule and emanates from it in gaseous particles—an effluvia—thus "infecting" other individuals through their organs of "respiration,"¹ and that the clothing is the a priori vehicle for carrying the "contagion" from one locality to another, thus "infection" is said to be spread from person to person,² from city to city, and from continent to continent!

But as frequently uncomfortably long periods occur from one "epidemic" to another, the "contagion" required to be provided with such attributes, that its "infecting" properties were indestructible, if it remained excluded from access to the air, and thus its efficacy would last for a number of years.³

Notwithstanding such an ample provision is made, yet the perplexing difficulty is not surmounted, as the fact forced itself to be acknowledged that "a great many" (to our observation more than two-thirds of the population) are not "infected" (i. e., remain exempt from having small-pox); their ingenuity assisted in crossing the gulf by introducing "immunity," and thus it appears that the hope is indulged in, that by means of a set of phrases a stormy ocean of contradiction is to be effectually tranquilized.⁴

The proviso "immunity" is shrewdly made use of when no other alternative is left; when the salvation found in vaccination and re-vaccination is disproved and contradicted; but nevertheless the "contagiousness" and "infectiousness" is represented so markedly potential, that no escape would seem possible, and the terrors of the monster variolous, "contagion" and "infection," from interested motives, are again assiduously agitated and upheld.

To illustrate to what an extent exalted ecstasy may heighten the phantasy, the following quotations will bear ample testimony:

(1) The untruth of this assertion is proved by the fact that O'Ryan of Lyon placed little children around a table, upon which refuse soaked with small-pox pus was placed, and for a week let them inspire the atmosphere that was thus infected by the "effluvia," however none of the children were "infected." Oesterlen *Seuchen*, p. 556.

(2) Every physician, his family and patients must be "blessed" with "immunity" or otherwise he ought to be the very source of multiple "infection."

(3) Niemeyer, l. c., p. 542.

(4) Oesterlen, l. c., p. 67, finds it astonishing to what an extent the "contagion" must be "endowed" with intelligence, as it seems to discriminate among the classes with discretion; it most always avoids those who live comfortably, clothe themselves well and particularly if wearing richly embroidered and gilded uniforms, or who have full purses at their disposal.

A slight variola epidemic in Philadelphia, during the winter of 1865, could directly be traced to two boys (cases 10 and 30) who were infected by picking a bale of cast-off clothing, received from one of the army posts.¹ The other, where bales of rags had been received from California, that contained parts of soiled garments, which *apparently* (!) had been used with sick persons, and were assorted by some female laborers, some of whom, in consequence, had taken small-pox, and then infected some of the members of their families, mostly children, although they had been "successfully" vaccinated previously. One of the miracles attending these cases was, that those who touched these rags with their own hands did not become "infected," but those who were differently occupied on the other end of the wareroom and those who by chance entered it to deliver orders.² A third illustration may be adduced, which is remarkable for the asserted *direct tracing of the "infection" from person to person*, viz:

"The contagion was brought (to the city of Greifswald, 1861) by a traveling journeyman from Mecklenburg, who on the ninth day of January was admitted to the hospital of the university of that place, suffering from a light form of variola. In the first months the spreading of the epidemic could be traced from this original centre of infection by uninterrupted radii, but later, as usual, cases were noticed that could not be traced back to a certain centre of infection. In the second and third week after his admission a number of persons in the hospital took sick, among whom was the machinist, who *conversed* with the original small-pox patient when he entered the hospital. Also the laundress who had washed his garments, and a number of patients in the medicopathological division, and two of the medical students.

The total number of small-pox cases in the city was 81, but those cases in whom infection could directly be traced in the hospital was 23. Infection took place in four series; the first numbered eleven cases, and the second, third and fourth twelve, consisting of nine patients, one nurse, one house servant and the barber of the hospital (his case occurred in the month of April). The emanation of the contagion by way of radiation (*Ausstrahlung*) from the hospital into the city was as follows: The machinist lived in the city; by him his wife, four other inmates of the same building, and three of his friends, who visited him during his sick-

(1) Amer. Journal of the Med. Science, Oct. No., 1869, p. 336.

(2) Boston Med. and Surg. Journal, June, 1875, per Westliche Post, St. Louis, Mo., April 19, 1876.

ness, were infected—total number 8. By one of these two other persons were infected. By one of the medical students, who had taken variola, a baker's journeyman was infected, who was employed in the house where the student resided. One of the laborers of the hospital, having taken small-pox, infected his wife, who visited him there during two days; she again infected her daughter.

From the small-pox hospital the following infections had taken place: One of the workmen was infected when he carried fuel (wood) up in the garret for several days; he again infected his wife and three children. The sister of the wife of this patient ultimately was taken sick and infected her husband and two children. Another woman who had visited the matron of the small-pox hospital occasionally, was infected and she again infected several of her neighbors."¹

Could the idea be admissible that from small-pox a "specific contagion" would emanate, by means of which individuals coming near would be "infected," particularly in such a manner as described by Ziemssen; and that the exemption or "immunity" as the author also emphasizes, was nearly exclusively due to vaccination and re-vaccination, why then was it deemed requisite even to recognize exemption, and how is it to be accounted for, that so many, who could not be, and never were vaccinated, do not take the disease, although the influences brought to bear upon them should have caused an "infection" unavoidably?

For the purpose of appreciating the actual merits of the above cited "records," the history of four typical cases may here be mentioned, exhibiting strong and sufficient evidence, that the so-called "infection from person to person" is entirely visionary. The first case is that of a post mortem examination on a woman who died of cruentate small-pox in the small-pox hospital of this place, 1869, where a fœtus was found of 6-7 months gestation, yet entirely free of any trace of variolous eruption. The second case was a young woman suffering from cruentate and confluent small-pox, whom I attended in private practice in the year 1870, when she was near the eighth month of pregnancy. She recovered in the ordinary space of time and after full term she was delivered of a well-formed healthy child free of any trace of small-pox eruption.² The third case was the mother of four children, who took

(1) Ziemssen, Greifswalder med. Beiträge, 1865; Band III, Heft, II, pp. 160-69.

(2) The history of two additional cases requires here to be mentioned taken from the records given by Ziemssen (l. c. p. 176) of the Greifswald "epidemic." One being a nursing baby, not yet vaccinated, taking the breast of his mother, who suffered from variola, but the child was not "infected," although being thus nursed by the mother for thirteen days during her sickness, when the child was "vaccinated" and passed but a regular course of "vaccinae." The other case was a new born infant without any variolous eruption, whose mother had just recovered from variola.

small-pox, of the semi-confluent form, while she was nursing her baby, who was not vaccinated; the mother recovered, the baby remained unaffected, and so the rest of the members of her family who were in daily attendance on her. The fourth case was an infant child suffering from the semi-confluent form of small-pox, who was nursed by its mother, yet the mother was not "infected." Or, moreover my own person ought not have escaped "infection," as I made ten postmortem examinations on persons that had died of small-pox (including the grave forms) in the months of January, February and March, 1870; examined microscopically and chemically small-pox pus, taken from the dead as also from the living. Also my own family, my patients in private practice, and all persons with whom I came in contact during that time, ought to have been "infected," as I did not even change my garments which I wore during post mortem examinations; hence the "effluvium," the "infectious X," the "contagion," &c., ought to have adhered to my clothing, especially, so that I ought to have been the medium—or the "central focus"—from whom a wide spread and deadly epidemic ought to have disseminated, but—quod non! Again, further or additional evidence may be mentioned, which also tends to contradict the notion that clothing must be looked upon as the vehicle "for conveying the small-pox poison." In the year 1866, when I was the physician in charge of the city hospital, it occurred that, owing to a large number of cholera patients there admitted, nearly all were entirely devoid of necessary garments, and a marked deficiency in the supply of clothing was experienced at the hospital. No other opportunity was afforded to obtain what was needed immediately than to use several bales of worn clothing, though previously cleansed, from the U. S. Army small-pox hospital, then discontinued. The clothing was at once turned over to the "wardmasters" and was worn by the patients throughout the hospital, "but the "infection" has not as yet come.¹ Such downright contradictions cannot be consistent with the supposition that even a shadow of truth is in the doctrine of so-called infection. "In nature there is no arbitrariness; all processes are the necessitated phenomena of the operations of unal-

(1) And farther, in the winter of 1870, a patient, in private practice, died of small-pox—of the confluent malignant form—who had been addicted to inebriation, and during illness was agitated violently by delirium, so that he constantly sprang out of his bed; he was thus left with his garments on and was attended by two male nurses—one for the day watch the other for the night. After death his coat was taken from the corpse and directly worn by one of the nurses, who—parbleu, is not yet "infected!"

terable physical laws. Hence simply from logical inference the proof is obtained that there can be no "infection," and consequently the occurrence of variola is dependent upon a different cause, of which the laws are those that are common to all other phenomena in nature.¹

When objects are held up to view, calculated to serve as an inducement for subordinating truth, or the actual nature of things, to the popular prejudices, it frequently happens that the most obvious facts are disregarded, for the purpose of accommodating them to the pre-established theories; thus "specific infection" is continually held out to the people, as a sort of a "woful apparition," as terms "being smitten"—"the scourge is upon us"—&c., when an epidemic prevails, are yet uttered by *medical* men. They bear sad testimony that the clear light of science is still deeply enwrapped in darkness, and the horrors entertained of the phantom "infection" find only a parallel in history in the writings of Plinius, when giving the description and natural history of the "salamander," he states: "The salamander is the greatest monster of all venomous animals; the others injure or kill only isolated individuals and not numbers at once. When they murder a human being by poisoning, they perish in consequence of their act, and are not tolerated upon the earth's surface any longer. On the other hand, the salamander may cause the extinction of entire nations, namely by crawling upon a tree and poisoning all the fruit, and he who eats thereof will die of frost, similarly as if he had taken aconite. Even still worse: if by the wood, which he may have touched with one of his feet, bread is baked, it is poison; equally so with the wells into which he may have fallen. Furthermore, if his foam is brought in contact with any part of the body, and even were it but the tip of the toe, all the hair upon the body will fall off."²

This quotation is cited for the purpose of giving prominence to, as is now regarded, an actually ridiculous imagination, bearing, however, perfect analogy to that of "specific infection," and that Plinius was not more wrong than the "infectionists" of the pres-

(1) Formerly the belief was entertained that inoculation of variola would occur by deglutition of small-pox crusts, until Zuelzer proved the contrary (Ziemssen, l. c., p. 337). His observations are verified by the following fact. Chickens fed upon small-pox crust, swept out from the wards at the small-pox hospital of this place, in 1869-70, and all remained entirely unaffected, laying eggs which were served at the table of the physician in charge; for my own satisfaction I have eaten some of them on several occasions without experiencing anything uncommon from them, so also the physician in charge and other hospital attendants.

(2) Translated from Westermann's Monatshefte, Vol. 35, p. 399.

ent day. If simply the nature of the morbid processes are investigated, and the material therein engaged, and the physical laws and agencies recognized causing the processes to assume special characteristics, the harmless nature of small-pox will equally as conspicuously stand out, as now the inoffensiveness of the salamander is universally acknowledged.

Under the head of morbid anatomy, the origin of the material essentially engaged in the development and morphological phenomenon of variola, will be indicated, and in this place suffice it to say, that the material is directly obtained from the human organism, and thus all possibility is excluded for irrelevant substances to have taken its place.

If for a moment the composition of the circulating fluids in the healthy state are borne in mind and the primitive processes (mere cleavage)¹ engaged in digestion, from which are elaborated (originally in common) plasmatic substances, which after being specialized by the activities of special organs through which they were circulated, and then remembering that by surrounding conditions those processes are so apt to be interrupted, and the synthesis or the composition of the resulting physiologico-(histo) chemical compounds thus seriously perverted, it must be clear that medical science would be lacking the knowledge derived from one of its most essential disciplines, viz: physiology, if such elementary data were not to be recognized in pathology, and especially in that of the morbid processes denominated variola. Again if the material is analyzed, in reference to the elementary nature and synthetical form of its combination and composition, which is and was active in morbid morphology—here the process of variola, the very same “ingredients” will be found which form the elementary basis of “vital” or physiological morphology; the difference which will be discovered is in the heterology of the synthetical representation of physiologico-chemical compounds of the inorganic nature of the circulating fluids, and their diffusion in irrelevant anatomical and histological territories. For instance: if, instead of chloride of sodium, lithates of soda and ammonia in comb. with lime—i.e., the carbonate—circulate with the blood and lymph, and, consequently, thus generating undue proportions of carbonic acid in these fluids, also carhuretted hydrogen with ammonia, such substances will gravely interfere with the circulation of blood and give rise to the formation or augmentation of “fibrinous fermenting substances,” constituting the basis of septi-

(1) See Gorup-Besanez Organ. Chemie, II, 53.

cal processes—deoxidization of the tissues—in the system,¹ and thereby forming the “predisposition”—“susceptibility”—for septical disease in general and to small-pox specially. When the influences from the surrounding conditions are sufficiently intense to irritate the surface to which the atmospheric air has access, the substances of regressive synthesis will then be circulated and deposited, ending with the formation of the variola pustule.

In the human system the organ in which regressive compounds are primitively generated is evidently the liver, for mere inapparent inequalities of atmospheric fluctuations exercise an interrupting influence over the blood circulation in this organ, and if but momentary interruptions then take place, the hydrolytic process for cleaving protoplomatic substances into glycogenic and mucenous compounds, is actually or in a great measure suspended.² The origin of the causes and consecutive formation of “fibrinous fermentative substances” may thus be found. An over proportion of carbonic acid and carburetted hydrogen with ammonia is from this time found in the circulating fluids, augmented by its own reaction in producing coagula in the blood³ and other albumenoids,⁴ therefore seriously interfering with the actions of the glandular system and causing the formation of ammoniacal derivatives in the tissue, attracted at the surface, to which atmospheric air has access, and but destruction must follow on account of deoxidization. The analysis of the blood of variola patients has verified and substantiated the correctness of these theorems. It has been ascertained that variola blood is deficient in glucose—has a superabundance of urea, and, consequently, an excess of carbonic acid gas. Also a diminution of its proportion of oxygen, in an inverse ratio to the height of the fever.⁵

The physiologist will readily recognize that when the circulating fluids deviate but on the minimum scale from the normal standard, structural changes must inevitably follow in the glandular system, as the albuminates cannot properly be converted, and albumenoids will hence infiltrate the tissue, leading to sus-

(1) Remarkable similarity—nay identity—is met with in the morbid anatomy as well as in the process of “infection” following transfusion with defibrinated blood and that of artificial putrid “infection,” which exhibit an indubitable analogy to septical “infectious” diseases. Köhler, Ueber Tramböse und Transfusion; Eiter—und Septische Infection, und deren Beziehung zum Fibrinferment. Dorpat, 1877, p. 104, sec. 8.

(2) For account in detail of these processes, see author's pamphlet on Yellow Fever, pp. 12-14. Pamph. on Cholera, etc., pp. 44, 45.

(3) Heynsins, Pflueger's Archiv fuer Physiol., 1869, p. 8.

(4) Not to be confounded with albumenates. For difference see L. Hermann, Grun-driss d. Physiol., pp. 32, 33.

(5) Coze et Feltz, pp. 198-207.

pension of function and consequently to the augmentation of morbid substances.

When describing the structural alteration of those organs in whose perverted or defective activities are to be found the actual sources furnishing the material essential to the production of variolous eruption, the fact will be demonstrated that in the interference of the function of the kidneys the source of the materies morbi of variola is to be found, for the reason that by the retention or incomplete elimination of the solid ingredients of the urine the essential material accumulates in the system, which in its decomposing reaction upon the blood and lymph, gives rise to those processes and chemical products that are demonstrable *ad oculos* in the ætiology of small-pox,¹ and in reference to the synthetical formation and deportment of those processes and chemical products, sufficient scientific evidence is now accessible for proving their ultimate issue and fixed character, viz: the "fever of infection," and the development of the variola pustule on surfaces only there where atmospheric air has access. Thus the evidence is produced that the variola pustule and the chemical agents therein engaged, urate of soda and ammonia, with carbonate of lime, is but an outward physical phenomenon of internal histo-chemical action constituting the disease—small-pox. The destructive effects of the solid ingredients of urine in solution on blood, even if their presence merely can be traced (uric acid requires 14-15 thousand parts of water at 20° C. for solution), have satisfactorily been demonstrated by the spectroscopic experiments of Prof. Preyer;² if, for instance, blood is mixed with some urine, the oxy-hæmoglobin impression quickly disappears upon a gentle elevation of the temperature, as the oxygen is thereby displaced from the hæmoglobin, owing to the decomposition of urea and uric acid, by means of which a superabundance of carbonic acid, with, perhaps, carburetted hydrogen and ammonia, is generated, and thus the albumen of the blood is coagulated. By a series of experiments St. Pierre and Estor corroborated the same fact; they displaced oxygen from the hæmoglobin of the blood by the access of carbonic oxide and carbonic acid, and Pflueger accomplished the same results with hydrogen, sulphuretted hydrogen and nitrogen gas.³

The facts established by these experiments bear most important testimony to the serious injury done to the blood, when heterol-

(1) Comp. Huchard, l. c., pp. 11, 12.

(2) Pflueger's Archiv der Physiologie, 1868, p. 438.

(3) Ibid, 1868, p. 293 and p. 77, resp.; also comp. Huchard, l. c., p. 15.

ogenous substances find access to it—or even homologous substances in but undue proportion.

Moreover, it must be borne in mind, that the alkali is expelled by the process of coagulation from the albumen, and is hence imparted to the liquids (lymph, etc). The lymph must consequently become deficient in the requisite proportion of chloride of sodium; thus the power for redissolving albuminous coagula is gravely encroached upon, or is actually suspended, and the accumulation of carbonic acid is most dangerously augmented; for the more the fluids of secretion react alkaline the more carbonic acid predominates,¹ as the alkalies have strong affinity for this acid. ¹

In the morbid process which medical nomenclature designates small-pox, the morphological changes, as fixed resultants of the reaction of the laws upon which they are dependent, and are here pointed out, are in their entire compass most clearly brought to observation. The origin of and the material engaged in the phenomena termed “the fever of infection,” as also the “stage of incubation” have above already been clearly indicated, and it only behooves us here to advert to the laws, process, and the elementary substances giving rise to the formation of the variola pustule; also simultaneously to establish the proof of the non-specificness of the substances contained in the variola pustule, or in other words to produce the conclusive and final testimony of the inadmissibility or the illusion of “specific infection” or “specific contagion.”

From the incipency of the feverishness—stadium prodromorum—the process of a uræmic decomposition of the blood and lymph (azoturia) is manifest, as long prior to this the function of the kidneys has been much impaired, and now structural changes of these organs have assumed such grave character as to interrupt the elaboration of urine to that extent as to prevent the vicarious action of other organs in compensation for the feeble activity of the kidneys. It, however, does not necessarily follow that an eruption, either papular or vesicular, is at this stage inevitable, for there is a large number of cases met with that simply exhibit the fever symptoms and no eruption whatsoever. If at this period the reaction of chloride of sodium in the blood and lymph grows predominant, even the premonitory “dermatitis” will be avoided as the thickening of the blood, which was the cause of the feverishness, is thereby overcome and whatever albuminous coagula

(1) Pflueger, *Die Gase der Secrete*, Arch. d. Physiol. 1869, p. 178. Also comp., Coze et Feltz, l. c., p. 207.

may have been precipitated, will be redissolved. On the contrary if the venous stasis progresses, owing to an augmentation of the morbid material above enumerated, the capillary vessels will become engorged—in those surfaces to which atmospheric air has access, owing to the attraction which azoturic material has for oxygen and ozone—and upon the “septical” relaxation followed by perspiration (rather transudation) from the ramifying venous vessels in the malpighian papillæ, the first step to the formation of the small-pox vesicles is made,¹ indicated by the red petechæ growing visible upon the surface, and are fed in the course of their development by additional excreted material, and by the destruction of the tissue particle of the locality where they have become located.

The correctness of the interpretation of the *modus operandi* in these processes and the physical principal or law giving rise to their occurrence, is well demonstrated by the instructive experiments instituted by Eulenberg and Vohl.² They stretched a membrane, soaked in water, over tube which contained gases; on application of gentle heat water pearls rose upon the exterior.

The processes in the human organism, leading to the formation of the small-pox pustule upon the exterior or integument, precisely correspond with those of the physical experiment, and the principle therein involved represents an actual identity. Previous to the eruption there is fever heat, terminating in perspiration, and during the perspiration the “petechiæ,” or the spot of the incipient small-pox vesicle grows visible. The consecutive phases of the pustule are simply expressions of the physical relations of the histo-chemical actions that transpire within it.

Before, however, the morbid actions, upon which the consecutive phases of the small-pox pustule are dependent, are further intimated, it would appear requisite to allude once more to the state of the blood, which as a *sine qua non*, precedes the external local affections. As above already said, a superabundance of carbonic acid is and must be found as one of the chief agencies contaminating the blood previous to any sign of small-pox, for pursuant to its presence the morbid alteration of the blood admit of rational explanation, and also the chemical evidences discovered in the products of decomposition in the pustules. The results, how-

(1) The reason why our urticaria, rubeola, scarlatina or even pneumonia results from these reactions, is to be found in the synthetical shading of the process, also in the anatomy of territorial diffusion: the air cells can not substitute the malpighian papillæ, the regressive actions from the composition of the circulating fluids is there less available.

(2) Die Blutgase, Virchow's Archiv, Vol. XLII, p. 191.

ever, which Brouardel obtained from research on the blood of variola patients, would tend to contradict the view of the superabundance of carbonic acid in the blood of patients who suffer from small-pox. He found the blood of a patient suffering from variola hæmorrhagica to contain a lesser quantity of gas than the blood of a healthy person,¹ but the fact is this: the blood was examined *after* the eruption had taken place, when the gases had, in a great measure, escaped from the blood to perform an active part in the establishment of the eruption.

This fact is well illustrated by the clinical history of most every small-pox patient, nay, in that of nearly every one who suffers from an exanthematous disease. After the eruption has taken place, the patient experiences marked relief, and in small-pox continues so until the stage of desiccation, when the exhalations from the exterior surface become greatly interrupted, leading to the stage of "agony," (a re-accumulation of gases in the system), in which—it is painful to acknowledge—too frequently the life of the patient is extinguished. But in verification of this fact more potent proof is at command than clinical evidence. By careful chemical analysis of the blood of rabbits "infected" with viruliferous matter it has been ascertained that oxygen at the death of the animal falls by 10.05 below the standard of normal blood, and carbonic acid rises by 5.55 *above* it.² Blood taken from variola patients for spectrum analysis does not exhibit the two normal hæmoglobin rays,³ and when into a concentrated solution of hæmoglobin of normal blood carbonic acid is conveyed—even in a low temperature (9-12 C.)—a dark discoloration ensues shortly afterwards, which to some extent will prevail although the solution may thoroughly be shaken up with atmospheric air.⁴

These evidences fully settle the question, that the dark color of the blood in variola patients (the arterial blood presents the same tinge of discoloration as the venous—see further on under "morbid anatomy") is chiefly or exclusively dependent on the superabundance of carbonic acid circulating with it, and then by contributing to displace the oxygen from the hæmoglobin of the blood corpuscles.

(1) Huchard, *Mort dans la Variole*, p. 10.

(2) Coze et Feltz, *l. c.*, p. 205.

Normal blood is noted to contain 15.5 per cent. O. and 30.8 per cent. C O₂.—Pflueger *Arch. d. Physiol.*, Vol. I, p. 367. According to Gorup-Besanez, *Physiol. Chem.*, p. 358—under 760 millimeter pressure at 0°—oxygen 22.2, C O₂ 34.3—and under one meter pressure, oxygen 16.9, and C O₂ 26.2

(3) Huchard, *l. c.*, p. 15.

(4) Preyer, *l. c.*, p. 420.

Now beside the lighter gases, carburetted hydrogen with ammonia, there is in the blood (and lymph) an irresistible agency, causing indisputably the expansion of the volume of the blood so characteristically met with in variola patients, and its chemical reactions upon the solid ingredients of the contents of the variola vesicle, in the process of decomposition, thereby causing the various peculiar phases, and final termination, in form of an actual demonstration.

Small-pox patients who were or are addicted to inebriation are generally suffering from the "confluent malignant" form, owing, naturally, to the great excess of carbonic acid in their system, and, consequently, predisposed, by far, to a more ready oxidation (the gangrenous hue of inflammation) of the cuticle, thus proving that the degree of difference in the process of destruction is merely an expression of an excess of the quantity of the essential material ordinarily required.

The ordinary or normal course of the processes transpiring in the small-pox pustule, is more conveniently accessible to observation in the "distinct" variety, as the transformation from one stage to the other is of longer duration, the peculiar phases being more definitely expressed, and the causes which give rise to these manifestations are thereby brought to recognition more readily and are made by far more comprehensible.

From beginning to end the fluid gathering and contained in the vesicle reacts decidedly alkaline to the test paper, and before opacity has set in crystals of urate of ammonia and soda are found upon evaporation and microscopic examination, but after, from suppuration, the center of the pustule is depressed (delled) and the stage of desiccation is about approaching, then mere precipitates of lime (I surmise carbonate of lime) can be discerned.

In the papillary or "acnous" form the liquid exuding, after having denuded a papilla of its cuticle, does not react so prominently alkaline as the fluid drawn from the vesicle of the "distinct" form, crystals of urate of soda cannot be discovered, but crystals of chloride of sodium can readily be recognized.

No other inference can be derived from these important chemical facts, than that the uric acid of the salts above indicated, was in the course of the morphological processes converted into carbonic acid, ammonia and water.¹ The superabundance of carbonic acid, and the ammonia with carburetted hydrogen, have penetrated the softened pellicle and escaped, thus lessening the vol-

(1) Comp. Gorup-Besanez—Organische Chemie 5th Ed., Art. Harnsäure.

ume of the contents of the small-pox pustule and from atmospheric pressure the centre portion of the vesicle is now depressed, constituting the "umbilicated depression" or "delle." The processes in the acnous form demonstrate that their causation is of a different character; there the amount of carbonic acid is not so great as to exclude chloride of sodium from the circulation of the blood and lymph, and therefore the regressive metamorphosis could not overpower the progressive or constructive metamorphosis, as the presence of chloride of sodium prevents the disintegrative oxidization of the albumen or the formation of "derivative" compounds and albumenoids, the elements of decay.¹

Arguments may yet be advanced aiming to contradict or to invalidate the inferences that are based upon the facts above set forth, with reference to the ætiological processes of small-pox, and asserting that the oxygen, expelled from the blood corpuscles by the reaction of carbonic acid or other gases, ought of necessity to serve as an equilibrium in the process of "revitalizing" the blood and thus suspending the further supply of the material actively engaged in the regressive—putrefactive—phenomena of variola. In answer thereto it is only requisite to invite attention to the fact that the oxygen thus displaced is absorbed by the process of decay, as its "vital" employment is debarred by the deficiency of chloride of sodium in the blood and lymph, which enters into the formation and into the products that constitute the variola process.²

(1) In corroboration of this view, Both, on Small-pox and Vaccination, 2d Ed., p. 49, says: "Small-pox consists in the escape of superfluous albuminous substances into the tissue of the periphery—the surface—of the body, caused by the want of salt." Also comp. Gorup Besanez, l. c., p. 448, § Harnstoff-chlornatrium.

(2) All processes of decay, strictly speaking, properly pertain to putrefaction—a septic fermentation—which have for their basis but chemico-physical laws; the belief that these processes are excited only by the access of "infusoria"—"sporulae"—"germs," etc. (L. Hermann, l. c., p. 517—Gorup-Besanez, *Organische Chemie*, 5th Ed., p. 53) is now to be regarded as no longer tenable, for the experiments and observations of Hilgard vide Both, on "Zymotic Fungus," stating that they are mere vitelline, self-multiplying and desultory forms of cell-genesis, and Koehler, "fibrous, fermentative substances," l. c., bear irrefutable testimony to the fact, that decay, putrefaction, or septic fermentation is excited without the access of "infusoria," etc., and vibronic action; the processes in the small-pox pustule also afford an illustrating proof.

Karsten—Fäulniss und Ansteckung—pp. 2 and 28, also acknowledges, with reference to the identity of fermentation and putrefaction, that both originate from physiologico- or organic-chemical actions, and that mere differentiation of the ingredients involved, will give rise to the development of different products. First: If to a fermenting solution of cane sugar a sufficient proportion of fresh meat, blood, or the like, is added, soon afterwards symptoms of putrefaction, under the evolution of bacterii, are noticed; if, on the contrary, putrid meat is immersed in a solution of cane sugar, yeast cells will spring up and the fetid odor will be overcome by lactic acid fermentation. Moreover: "From Morbidly altered glandular organs, in conjunction with their morbid secretions, owing to their abnormal chemical constitution the most recent cells will degenerate into pus, micrococcus—bacterii—etc., cells." On the contrary when the reaction of chloride of sodium penetrates the tissue, morbid action becomes modified into healthful action, and in convalescence the predominance of chloride of sodium is on an inverse ratio as disease recedes. Golding Bird, *Urinary Deposits*, p. 111.

GENIUS EPIDEMICUS.

That there is no "specific infection" may have already become evident in the foregoing considerations of the pathogenesis and ætiology of small-pox, for the present it remains but to show what special influence of the general causes an epidemic is dependent upon. Prominence has been given to the evidence that the reaction of physical laws can alone be recognized in the causation of an epidemic, the basis of which rests upon the great truth, that nothing upon the surface of the earth—nay, even in the universe, stands an exception to the laws of nature.

The unbiased observer will always be ready to admit that every individual representative in the *organic* world is dependent upon the essential or normal conditions of surrounding influences, the health or maintenance of life in man, hence, is dependent on essential atmospheric or climatic conditions; their degree of intensity must be proportionate to the amount of biostatic action incorporated in physiological processes characterized by the indigcnous or native born in chorological distribution. But with the adoption of the doctrine of "specific infection," this is different, all the difficulties attending a correct interpretation of the causes of morbid phenomena, epidemics in particular, are thereby conveniently surmounted, because it is then only necessary to assert that small-pox is generated, propagated or transported (*verschleppt*) by means of a "contagion," emanating from afflicted individuals and fastening upon others. The route it follows, it is said, is always the commercial highways, as travelers and traffic in textile fabrics are looked upon as the media of conveyance from one station to another—nay from one continent to another.¹

However, with ordinary care of observation and veracity of records, the evidence will frequently be found that many cases occur in which there was no exposure to "infection" from commercial transitor other "centres," and, therefore, the autochthonic origin of variola is fully demonstrated. The law is well sustained that from influences, similar in kind, diseases dissimilar in character or form will arise and are merely due to slight variations of the degree of those influences, so that in some persons, small-pox may

(1) Comp. Geigel, vide Ziemssen, *Hanbuch*, etc., p. 53; Ziemssen, *Greifswalder Beiträge*, 1865; also Pepper, *Chrschmann* and *Robinsky* l. c.,

develop, in others diseases of no special type. But, as general influences approximate more characteristic peculiarities, their reaction upon the human organism is responded to also by more characteristical chemical synthesis of histo-pathological action, (the qualitative and quantitative changes, or the predisposition, according to the nosological terminology of our immortal Professor Linton),¹ and owing to the intensity and duration of the reaction of such influences, the degree of homogeneity in the heterogeneous character of the morbid processes will be determined. If the number of cases thus occurring, exceeds that of the common standard, such an event is denominated, according to usage, an "epidemic." The law of biology is evident universally, in vegetation as well as in animal life. Individuals must adapt themselves (become acclimated) to the influences of a differential nature, as otherwise serious changes ensue in their constitutional aspect, ending most frequently with entire disintegration, for thus the power of resistance is morbidly lowered and necrobiotic actions take the place of archebiotic or biostatic actions. Their degree of intensity, or the volume of magnitude, is marked by the ratio of regressive actions receding from the line of demarkation of progressive actions—or that separating constructive from destructive metamorphosis.

The outward manifestations of morbid action, with reference to form or character of disease, may be said to be determined (in a sense of crude generalization) by geographical range of climate. Smallpox, therefore, like pneumonia, is a disease pertaining to or is (?) indigenous to the catarrhalic and entero-mesenteric regions, or to the climate of the hibernal season. Cholera is a disease pertaining to the entero-mesenteric and dysenteric regions, or to the climate of estival and autumnal seasons. Yellow fever to the dysenteric region and its autumnal season.²

(1) Concurred in also by Virchow; see Cell-Pathol. 4th Ed., p. 394.

(2) However it has been stated by the President of the Epidemiological Society, of London, in a meeting held November 12th, 1872, that the epidemic of small-pox of 1871-72 was widely spread. In Europe and Africa it ranged from south of the equator to the Arctic ocean; in Asia from the southern India to Siberia; in America from Chili to Canada—Comp. Report of the Board of Health, Philadelphia, Pa., 1872, p. 72. Nevertheless, these statements do not invalidate the arguments set forth in the text, for they failed to indicate the season of the localities where small-pox prevailed. The observations of Colin—La Variole, pp. 6, 7—derived from tabulated statistics, are hence the more important, he says: "The mortality from variola reduces to minimum in the months of June, July and August; in September it rises again, and continues so regularly during the winter months; in the spring it again declines to the minimum by the time the summer season has set in."

In the "Lancet," June 16, 1877, p. 503, it is stated that "small-pox epidemics in London during the past 37 years bear testimony that the deaths from this cause, decline with the advent of warm summer weather. The recent weekly returns of the Registrar-General appear to indicate that the course of the present epidemic will form no exception to the course of the former epidemics." And Hirsch, quoted by Geigel, vide Ziemssen, Handbuch, etc., Vol I, p. 54, states that, of 219 small-pox epidemics 39 occurred in the month of December, whilst in the month of August only six. This fact would be the more important and interesting if the geographical stations were indicated.

So far historical and statistical evidence is available at my hands, although in its numerical strength it is but limited, however intrinsically of sufficient force to afford conclusive testimony to sustain the above indicated axioms, viz: small-pox being indigenous to the catarrhalic and entero-mesenteric regions, or to their climate and season.

The epidemic of small-pox to which allusion may here be made is that of 1869-70, of this place, principally for the reason that during the period of its duration all our own research and observations were made. It commenced in January, 1869, and lasted until May, and again began in November and lasted until the early part of May, 1870. During these last five months of the hibernal season, the number of cases that are recorded is 511, of which 326 were admitted to the small-pox hospital, and 185 are reported by the health officer.¹

The epidemic by which Paris was infested in 1870-71 began in the month of October, reaching its maximum in December, thence it declined and was extinct in March. The number of deaths from small-pox in this epidemic was 7,416.²

The epidemic of Philadelphia, Pa., in 1871-72, exhibits a remarkable correspondence with that of Paris: it also began in the month of October and continued to increase until the maximum was reached in December, but this epidemic remained stationary, with slight fluctuations, until January, when it suddenly declined to a minimum in the month of March (least number of deaths from small-pox being 75 per week and maximum number 233). Towards the beginning of July the epidemic was extinct. The total number of deaths from small-pox in this epidemic was 4,464.³

The prevalence of small-pox in New York, 1871 (as an epidemic in comparison to other localities it remained on the minimum scale), rather exhibits a deviation from the maxim here attempted to be established; nevertheless it reached its maxima while the atmospheric temperature was below freezing point (during the hot months the minima prevailed and upon the approach of winter the maxima appeared again). A graphic line would read thus: minimum at January 1st and gradually elevating to the maximum April 1st (34 deaths per week), from this period declining

(1) Official Report from small-pox hospital and Ann. Report of Board of Health, of this place, for 1870.

(2) Colin, l. c.

(3) Report of the Board of Health, Philadelphia, Pa., for the year 1872, and see Chart to p. 71.

to a rate of $\frac{2}{3}$ on July 1st, and then lowering to the minimum until November 25th, when again it ascended to the rate of $\frac{2}{3}$ of the maximum, which occurred December 31st.

The epidemic which raged in London in 1871 presents quite analogous features to that of New York, the rate of mortality, however, ranges by far higher; here also a graphic line would exhibit a *gradual* elevation to the point forming the maximum (May 6th with 288 deaths per week), then gradually decreasing to July 1st, and from thence lowering to the minimum for the rest of the year. Another epidemic from which the inhabitants of London suffered severely, occurred in 1840, but the highest number of deaths is recorded for the last week of the month of December.

The history of an epidemic, visiting the city of Berlin, 1871, sets forth apparently contradicting evidence, as there a high rate of mortality from small-pox is recorded for the summer months; from the minimum, which is rated for January 14th, a gradual increase followed, ascending to the maximum June 24th, then declining to a semi-maximum September 23d, when again an increase occurred, reaching its maximum December 9th then gradually receding to extinction.¹ The epidemic of Paris, in the year 1870 also exhibits the peculiarity of a gradual increase from the minimum of January to July, when, like in Berlin, a decrease followed and here to the month of October, then the disease alarmingly increased to the height of the maximum in December.²

These apparent discrepancies nevertheless bear evidence to the general law; in a climate characterized by the period from the summer solstice to the autumnal equinox, small-pox ceases to be indigenous—for the slight diversion from this law, meteorological extremes must be held accountable, which are apt to have occurred owing to the continental climate of both last named localities.³

(1) Reports of the Board of Health of the city of New York for 1870-71; of the latter see Chart at p. 190.

(2) Colin, l. c.

(3) The monthly mean ordinarily of barometrical pressure and of temperature at Paris is for the summer months as follows:

Barometer,	Thermometer, R. Scale,
June, 757.28	13.66
July, 759.52	14.96
Aug. 759.74	14.82
Sept. 759.61	12.52
At Berlin—June, 759.81	13.94
July, 759.58	15.04
Aug. 759.02	14.43
Sept. 760.53	11.75

These tables are copied from Mueller, Kos. Physik, pp. 456-58 and 578.

In the year 1873 small-pox prevailed at New Orleans, La., to some extent; 1,300 cases of variola and varioloids were registered for the entire year, but the course of increase and decrease in frequency with reference to the season, testifies to the same law, viz: during the summer months—i. e., from the summer solstice to the autumnal equinox—the disease fades away to the minimum, and in the hibernal season—from autumnal equinox to winter solstice, thence to the vernal equinox and even to summer solstice—it arrives at its maximum.¹

A graphic line for New Orleans would be traced thus: From January with a $\frac{2}{3}$ maximum a gradual elevation to March where the full maximum was reached, then a gradual decline to June—to a degree of $\frac{1}{3}$ maximum. For the months of July, August, September and October but the minimum; for November and December an elevation again, indicating a degree of $\frac{1}{2}$ and $\frac{2}{3}$ maximum respectively.²

Re-adverting to the epidemic of Philadelphia, further above alluded to, and contrasting it with that of New York of the same period, the law of causation probably may now be more clearly comprehended after the general or fundamental law has been traced out. By examining then the meteorological data which are recorded for both localities, and bearing in mind that Philadelphia has an oceanic climate, owing to its geographical position, at once the fact suggests itself incontestably, that in the perverted states of atmospheric influences the causes are demonstrated, accounting for the occurrence of the epidemic in general, but for the remarkable sudden increase and the height of the degree of intensity by which this epidemic is specially characterized. The climatical or meteorological peculiarities attending Philadelphia during this period were decidedly of the continental characteristics whilst those of New York less so. These facts may be learned by consulting the following contrasting tables:

Monthly means for the year 1875-76 when no small-pox or epidemics prevailed.³

PHILADELPHIA.

Month.	Barom.	Therm. F. scale	Rainfall in inches.
July.....	29.996	74.6	3.63
Aug.....	30.035	72.4	6.42
Sept.....	30.035	64.1	2.53
Oct.....	30.015	53.7	1.42

(1) For further support of this axiom, comp. Jahresbericht der gesammten Medicin Vol. II, p. 248, where is stated that in 1869 variola prevailed nearly throughout the entire year, but the epidemic character was presented in the months November, December, and to some extent in the month of May.

(2) Report of the Board of Health for 1873, p. 19.

(3) These tables are copied from Ann. Reports of the Chief Signal Officer, U. S. A., for the years respectively.

Month.	Barom.	Therm. F. scale.	Rainfall in inches.
Nov.....	30.107	39.7	5.40
Dec.....	30.042	34.7	3.37
Jan.....	30.161	37.7	1.52
Feb.....	30.131	34.0	5.03
March.....	30.040	37.4	6.71
April.....	30.004	49.1	2.16
May.....	30.054	60.9	4.45
June.....	29.998	74.2	2.29

Monthly means for the year 1871-72, the year of the small-pox epidemic:

Month.	Barom.	Therm. F. Scale	Rainfall in inches.
Oct.....	30.140	56.5	....
Nov.....	30.046	40.5	4.09
Dec.....	30.146	32.9	1.57
Jan.....	30.053	29.4	.95
Feb.....	30.011	31.2	1.12
March.....	30.054	32.1	3.67
April.....	30.063	51.6	2.60
May.....	29.975	61.5	3.15
June.....	29.976	72.7	4.29
July.....	29.970	78.6	9.20
Aug.....	30.045	75.9	7.81
Sept.....	30.049	67.5	3.66

NEW YORK.

Monthly means for the year 1875-76.

Month.	Barom.	Therm. F. Scale.	Rainfall in inches.
July.....	29.991	72.6	5.23
Aug.....	30.045	74.0	10.42
Sept.....	30.031	63.8	2.51
Oct.....	29.992	52.7	3.13
Nov.....	30.080	38.9	4.43
Dec.....	30.020	33.1	2.78
Jan.....	30.123	35.1	1.21
Feb.....	30.114	31.6	5.39
March.....	30.020	35.0	7.90
April.....	29.986	46.1	3.79
May.....	30.047	58.4	3.94
June.....	30.001	70.8	2.87

Monthly means for the year 1871-72.

Month.	Barom.	Therm. F. Scale.	Rainfall in inches.
Oct.....	30.130	54.8	7.07
Nov.....	30.090	39.3	3.76
Dec.....	30.075	30.3	1.19
Jan.....	29.997	29.9	2.34
Feb.....	29.968	31.8	1.44
March.....	27.986	30.3	3.93
April.....	30.014	49.7	2.49
May.....	29.894	61.9	2.25
June.....	29.942	72.8	2.93
July.....	29.938	76.2	9.36
Aug.....	30.013	75.2	6.08
Sept.....	30.014	65.8	3.44

Ample prominence is gained by the comparison of these tables with recorded historical data of the small-pox epidemics of both localities, in support of the law, that, in meteorological variations are to be found the causes of an epidemic.

The state of the weather at Philadelphia in 1871-72 is thus proved abnormal to the locality, for the variations indicate the prevalence or the characteristics of a continental climate, expressed, principally, by undue wide range of temperature, accompanied with a reduction of rainfall (in December a maximum of rainfall is due),¹ and a rate of barometrical pressure approximating comparative minima.

With the degree of irregularity of the meteorological conditions, exactly correspond the fluctuations in prevalence of the epidemic, and on a ratio of the subsidence of meteorological variations, the epidemic recedes to final extinction. For New York the same facts and the same law are patent, and with remarkable precision of proportionate percentage.

Moreover, if the elevations of a graphic line denoting relative humidity at Philadelphia are examined, it will be seen that shortly prior and during the height of the epidemic, maxima of 76° and 78° (100° being the point saturation) are indicated,² forcibly bearing testimony that normal evaporation was effectively interfered with by a stagnant atmosphere, which is deficient in the normal percentage of ozone, and hence favoring regressive action.

The increase again of the number of variola cases in New York in the months of November and December, 1871, precisely correspond, as already stated, in exact proportion to the fluctuations of the state of the weather, recorded for these months (weather records for the period from January to October, 1871, are not in my possession) and thus the law above pointed out, with reference to the meteorological influences actively engaged in the causation of the epidemic in Philadelphia, is directly verified and corroborated.

Most positive proof is further submitted by the tables which now here follow; they also give a comparative statement of the weather but of this place, (St. Louis, Mo.) and at first for the year 1869, when the small-pox epidemic prevailed, and secondly for the year 1877, when no small-pox existed. Two fundamental principles are verified by the data of these tables, viz: firstly, that in the period from the summer solstice to the autumnal equinox small-

(1) Comp. Ratzel, *Die Ver. St. von Nord-America*, B. I, p. 314.

(2) See Chart to p. 71, Report of the Board of Health for 1872.

pox recedes to the minimum, and secondly the principal one: disproportionate variations of temperature, of relative humidity and an undue diminution of positive electricity prevailed.¹ In conformity with the chronological prevalence of these meteorological inequalities the prevalence of small-pox also coincided.²

Table of monthly means of meteorological data, observed at St. Louis, Mo., 1869, when small-pox prevailed:

Month.	Barom.	Thermometer, F.	Rel. Humidity.	Pos. Electricity.
Jan.....	Barometer observations were not recorded for '69.	39.4	76.1	8.7
Feb.....		36.9	76.1	2.5
March.....		39.9	74.7	4.6
April.....		56.3	61.2	1.6
May.....		66.6	66.1	0.7
June.....		74.7	69.3	0.9
July.....		80.7	70.3	1.1
Aug.....		82.1	74.2	0.3
Sept.....		68.2	75.4	1.3
Oct.....		47.9	73.2	7.8
Nov.....		40.9	79.2	4.7
Dec.....		33.8	81.8	1.6

Table of monthly means for the year 1877, when no small-pox or other epidemic prevailed.

Month.	Barom.	Thermometer, F.	Rel. Humidity.	Pos. Electricity for 1872.
Jan.....	30.198	31.5	69.9	10.7
Feb.....	30.200	41.7	63.2	12.3
March.....	30.048	38.6	65.8	9.0
April.....	29.895	54.6	62.7	5.1
May.....	29.975	63.7	61.2	3.0
June.....	29.911	74.6	68.2	1.5
July.....	29.959	78.4	62.4	0.5
Aug.....	29.961	76.0	63.2	0.4
Sept.....	30.004	69.8	66.9	1.7
Oct.....	30.000	59.6	69.6	4.1
Nov.....	30.083	42.3	67.1	4.0
Dec.....	30.110	48.0	70.0	2.7

NOTE.—The quotations of positive electricity added to the table for 1877, pertain as indicated, to 1872, in which year, however, neither any small-pox prevailed, but to convey a correct

(1) Positive electricity may be regarded synonymous with ozone.

(2) For the months of January and February, 1870, a noted increase of positive electricity is recorded and small-pox not only prevailed in these months—nay, sometimes the number of cases was on the increase. Although these facts appear contradictory to the theory above advocated, yet they neither invalidate it or reflect doubts of its correctness, for it must be borne in mind that oxygen or ozone will be appropriated in the process of decay, or by regressive actions, even if these elements find access in excess. Their "vital" employment requires a due percentage of chloride of sodium in the circulating fluids, and if from the "predisposing causes" the presence of this salt is replaced by morbid compounds—e. g., by the urates—then an increased access of oxygen or ozone, for the time being, can only attribute to augment decay and putrefaction. Hence small-pox continued to prevail during the fore part of 1870, until all climatal or seasonal inequalizations were counterbalanced.

idea of the extent of the minimum of positive electricity for 1869, a maximum table may here be reproduced, which is recorded for the year 1863, when no epidemic of any description prevailed:

Jan.....16.9	May.....4.7	Sept.....4.8
Feb.....15.9	June.....2.0	Oct.....12.5
March.....13.6	July.....2.8	Nov.....12.1
April.....8.8	Aug.....4.4	Dec.....11.5

Further my obligations to Dr. A. Wislizenus are here acknowledged, for kindly furnishing the meteorological tables for 1869; those for 1877 were kindly furnished by the U. S. Signal Service; the records of mortality, by the Health Department of this city.

If now attention may be directed to those influences, constituting the local causes, and if it be remembered that persons who are constantly exposed thereto possess the least resistance against powerful and destructive reactions of cosmical influences, the law of causation—here in reference to small-pox—grows prominent in its entire extent, and in its support statistical data corroborate its validity by direct demonstration.

The records of Philadelphia elucidate the fact that during the small-pox epidemic, 1871-72, the greatest percentage of cases and mortality is precisely in an inverse ratio to the comforts of life and general intelligence enjoyed by the population,¹ and the statistics of St. Louis prove the same fact for the cholera epidemic in the year 1866 (small-pox statistics on this point are not available²), but the evidence accruing from private practice afford proof to the same effect. Local causes may therefore be found to rest chiefly in over crowded dwellings and too densely inhabited quarters of cities or towns. Also in occupying ground from which are exhaled gases that materially contribute to the impurities of the atmospheric air, or deprive it of its essential percentage of ozone; or by occupying localities of which the surroundings emit similar impurities.³ Further must be admitted, as local or predisposing causes, viz: neglect of proper sanitary or personal police, leading to suppression of the exhalations from or of the performance of the function of the skin; also undue exposure followed by the same effect. Again, causes that arise from improper diet and lead to lesions of the organs of secretion: such as—e. g.—structural changes of the kidneys. Either one of the enumerated local or predisposing causes, or all combined, tend to develop in the

(1) Comp. tables on pp. 19 and 66, Report of Board of Health.

(2) Comp. Author's treatise on Cholera, 1877—woodcut, p. 38.

(3) Concurred in by Geigel, vide Ziemssen, Handbuch, etc., Vol. I, p. 55

system of individuals constantly exposed thereto, morbid conditions that are termed acute (incipient) uræmia or azoturia contaminating the blood or circulating fluids (blood and lymph) to that degree, which if failed to be corrected by other vicarious actions, is coerced to react regressively, especially under irrelevant cosmic or meteorological influences, and causes the products of these processes to assume typical (specific) forms in accordance to the special character of the reaction of those influences. From aggravated predisposition may spring up even under ordinary atmospheric influences, and at any season of the year, isolated cases of variola, which are commonly designated sporadic cases or "endemics." It must appear self-evident, that in proportion or on an inverse ratio azoturia predominates, chloride of sodium is displaced from the blood and lymph corpuscles, and thus causing albuminates, far more easy, to coagulate, which they do on a ratio to the diminution of the presence of atmospheric ozone or positive electricity, for negative electricity coagulates albumen at once,¹ and thus expelling the lighter gases, leading to the formation of trombi in the capillary vessels. However, if the necessary proportion of chloride of sodium is present in the circulating fluids, those results do not occur,² under ordinary conditions (i. e., without great extremes). Further above it has already been mentioned, that under the reaction of chloride of sodium (3 to 4 per cent. concentration), organic compounds, which otherwise are converted by regressive action to entire decomposition or disintegration, are directly appropriated as life matter (protoplasma) from which again hæmoglobin (zoid) originates.³ If, to the contrary, the same material remains devoid of chloride of sodium, but regressive processes, augmented by favorable atmospheric conditions (i. e., abnormal for healthy action in man) grow out from it, developing in the primary step, primitive and autogenous organic forms, denominated by Hæckel "moneren," and, according to this observer, from which other growths emanate by cell progeny⁴ which may represent the form of "Leptothrix," "Schizomyzeten," Bacterii," etc., the dreaded agencies of "specific infection."⁵ From the natural history of these deriva-

(1) Todd and Bowman, *Physiological Anatomy*, p. 53.

(2) Albumen mixed with water and heated to 88 deg. F., indicates traces of coagula, but with the admixture of a solution of chloride of sodium (4 per cent. concentration) these traces are only observed when the mixture is heated to 150° F.

(3) Dennis von der Horst, quoted by Heynsius, *Pflueger's Archiv f. Physiol.* No. 1, 1860; also comp. Happe-Seyler, p. 203.

(4) Comp. *Generelle morphologie, and Natuerliche Schœpfungs geschichte*; also comp. Hilgard, vide Both on Small-pox, 2d Ed.

(5) Comp. with regard to the morphology and functions of these bodies, Hallier, *Die pflanzlichen Parasiten*, p. 60; Kasten, *Chemismus der Pflanzenzelle*, p. 80.

tive bodies it will be learned that they are even essential to our existence, f. i., *leptothrix* (yeast) so largely employed in the manufacturing of bread, beer, etc., hosts of the cells, which have remained unconverted in the process of fermentation, are thus daily consumed by man with the ordinary nutriment. Their chemical constitution is also well learned, from the fact that they derive their nutriment from the plasma in which they are suspended and originate. The proof is produced by Hæckel. This great author injected indigo into the medium those cells were suspended and the coloring matter was consequently found absorbed by these cells and embodied in them.¹

The morphological facts, to which allusion required here to be made, bear evidence of the metabolian character of tissue elements, and that there is no "specific-infecting" agency required to produce in the system a transmutation of physiological compounds into morbid products, and that derivative compounds or products are liable to be physiologically converted into constructive material or plasma for serving healthful or life actions, all of which can for any scientific consideration only be recognized as totally dependent upon the influences or reactions of physical laws. Therefore the laws of the causation of epidemics in general, and of those of variola in particular, can only be found in meteorological inequalities or irregularities of the hibernal season, characterized by the prevalence of a continental climate in localities to which, naturally, an oceanic climate pertains, and vice versa. To ascertain the essential and subtle variations of these influences for the production of special—specific—phenomena, remains a subject for further inquiry and more minute observations.

(1) Virchow, *Cellular-Pathologie*, 4th Ed., p. 362, also acknowledges these facts. Boehm, vide Hueter—*Gelenk-krankheiten*, 1870, Vol. I, p. 38, states: "To have injected an emulsion of oil and cinnabar into synovial cavities of lower animals, and found after an elapse of 24 hours, with decided evidence that the coloring material was contained in the cells "des epithelioiden Bindegewebes." Further, Stricker, *Handbuch der Lehre von den Geweben*, 1871, p. 12, states: Becklinghausen "fed" the cells with substances stained with coloring matter and consecutively found them to migrate and locate at different localities. Also, Ponfick, *Virchow's Archiv*, Vol. 48, p. 9, found, by taking cells from the pulp of a frog's spleen and exposing them—in the "moist chamber" for microscopic examination—to the access of serum containing cinnabar, that after an elapse of a few hours the coloring material is contained within those cells. Moreover, that, owing to changing the chemical or plasmatic constitution of cells, their typical character transforms most radically: from the perichordium connective tissue cells will grow—which can change into hyaline cellular cartilage, and, finally into true cartilage.—Comp. Eberth, *Untersuchungen aus dem Pathologischen Institute zu Zuerich*, 1875, Heft III, p. 20. Arnold, *Virchow's Archiv*, Vol. 46, p. 168, et seq., furnishes additional proof that epithelial cells may directly grow from connective tissue, or to develop in mere protoplasmatic substance. (The facts have not been disproved, although the attempt was made by Dr. Wadsworth, of Boston, in conjunction with Prof. Eberth, Zuerich. Also by Dr. Hoffmann, Berlin. Comp. *Virchow's Archiv*, Vol. 51, p. 361, et seq., and p. 373, et seq.)

MORBID ANATOMY AND HISTOCHEMISTRY.

Frequently, by means of pleasing phrases and a fascinating perspective in profile, efforts are crowned with success to such a degree as to bestow upon them an aspect of probability and the appearance of genuine actuality, and thus to prepossess a great majority of enthusiastic followers with an unbounded faith in the counsel of a mere delusion. Accordingly in a grandiose effusion of mere declamation, the deadly power of infection, in all its forms is continually proclaimed, and the study of morbid anatomy in variola has been pursued according to an inverted method: instead of a most thorough research of the structural changes of internal organs, and an analysis of the processes of their morbid functions, the *prima facie* object, the pustule—the physical outward form of the internal morbid process—has attracted most all attention, and is hence described by all writers (as far as evidence has come to my observation) as first in order and as the principal object of the task. With equal design it is frequently asserted, even without hesitation but in a mood of resignation, and with an air of apparent modesty, by repeating the assertion that of the nature of variola as yet nothing positive is known. So far, however, as positive knowledge extends in anatomy, histochemistry, physiology and physics, the assertion can safely be ventured, that something definitely of the nature of variola is at our command, and that among the facts thus cleared, stands one conspicuously prominent, namely: the hitherto entertained—but hypothetical—specific contagion or infection, as the *spiritus rector* in determining variola now being found, on the admission of general science into medicine and on the evidences of statistical data, as one of those illusions that have their centre of gravity in metaphysical abstractions and in dualistic corruptions.

Toward the apparent purpose, concealed by the negation of “better information,” the mindful observer can no longer be indifferent, for the intention is evidently—with reference to variola—that the nature of objects is expected to be judged at random, in order to aid and comfort the customary (so called) sanitary rulings and to vindicate for them legitimate rights. With these designs

agrees the plan pursued in the description of the morbid anatomy, for the structural changes of internal organs are but *en passant* mentioned as secondary effects of the "specific small-pox poison." However, to proceed on the natural basis, *a priori*, the course must be reversed and the morbid alterations or entire destruction of internal organs, furnishing the material for the development of variola, are to be described as first in order. But to anticipate an over estimate of the value of the morbid evidence here to be submitted, it may be proper to state that the number of corpses submitted to post mortem examination was ten, and embraced the "eruentate," "confluent" and "distinct" forms of the disease. On opening the abdomen, the omentum is most always found in a state of venous turgescence, the bowels and the stomach, however, with scarcely any morbid appearance. The mucous membrane of the intestine exhibits neither morbid alterations, except such that arise post mortem. Brunner's and Peyer's glands are of natural size and color, so Lieberkuehn's follicles and villi; they also have their epithelial coating. Sometimes discolorations are met with at the ilio-cæcal valve, though rather limited, and as far as the extent of the evidence goes, this morbid condition is only observed in cases that die of the "eruentate" and "pasty" form.

The spleen is always found much enlarged, occasionally from four to five times of the usual dimension; on pressure with the point of the finger very frequently it yields readily, and upon cut surfaces exhibits an uncommon whitish material, which seemingly swelled the trabeculæ or infiltrated the pulp.

Similar morbid changes are observed in the liver. Its size is also greatly increased, sometimes to double the volume, and nearly in every instance it readily yields to the pressure of the point of the finger. On section the surfaces present the same whitish substance as the spleen, with which the parenchyma also seems to have been infiltrated.¹

The kidneys also are found infiltrated, similarly as the liver and spleen, and in every case these morbid conditions are inva-

(1) The observations in reference to the structural alterations of the liver, spleen and kidneys, are fully verified by the research of Quinquaud, Denos, Huchard, Knecht, and others, who found in those organs an albuminous infiltration and a fatty degeneration. Wagner, however, who, it is stated, examined 218 corpses that had died of small-pox at Leipzig in 1871, found the liver in the majority of instances not to present the above indicated morbid alteration, "the ulterior minute fatty degeneration for the recognition of which special inquiry was made, was equally as frequently missed as noticed; in the kidneys it was more frequently noticed than in the liver."—Comp. Friedberg l. c., pp. 24 and 25.

riably more prominent. Frequently these morbid changes are so extensive as to obliterate the cortical portion entirely, and sometimes only a few of the pyramids can be distinguished, and then only with difficulty. Surfaces laid bare by incisions, that are carried from the convexity to the hilum and through the longitudinal, and through the transverse diameter, plainly exhibit lardaceous, albuminous and white hues, but they do not yield to the pressure of the point of the finger and thus they indicate that the infiltrating material has undergone, by regressive metamorphosis, an organization. Microscopic specimens, taken from the cortical portion, exhibit no vascular elements, or no striæ that characterize the muscular layer of blood vessels; only straight tubes, probably the straight portions of the tubuli uriniferi. Upon the iodine test, reacted upon by sulphuric acid, these specimens exhibit light blue and frequently greenish blue bodies, which are said to be indications of an amyloid degeneration of tissue.¹

The supra-renal capsules are always found softened and decayed, and so seriously that not the slightest trace of structure can be made out; they merely present a brownish, mushy mass, enveloped by their surrounding cellular tissue.

The mesenteric glands are quite regularly enlarged, and present upon the exterior a dark color, owing to a collection of dark venous blood in the vessels of their surrounding areolar tissues; sometimes they are soft.

The sympathetic nerves (superior cervical ganglia) also present venous hyperæmia upon the exterior.

Of the lungs the post mortem appearance varies. In the majority of instances they present the melanotic hue, with dark blood oozing out of freshly cut vessels. Occasionally red hepatization is met with at the base of the right lobe, also pleuritic affections with adhesions of the pulmonary to the costal pleura are observed, and sometimes emphysema.

The tunics of the brain, with the exception of the arachnoid membrane, present nothing of pathological interest, and in this only the venous vessels are engorged with dark blood, from which, however, no serum is exuded. The cerebral substance presents rather an anæmic hue.

The blood exhibits no difference in color; the arterial blood presents the same hue as the venous. This fact was ascertained

(1) Beale, *How to Work with the Microscope*, p. 136.

by taking blood from the median cephalic vein and from the superficial volæ artery (by vivisection) which, each separately, was conveyed into test tubes that contained weak solutions of chloride of sodium. The person from whom the blood was taken was a young man, about twenty-two years of age, and apparently free from vicious habits; he suffered from a fully established form of "distinct" small-pox.

The chemical analysis of the blood has indicated an augmentation of urea to 0.05 over the normal composition, which is about double the quantity; a diminution of $\frac{3}{4}$ of the glycose, and a diminution of oxygen.¹

Andral and Gavarret, quoted by Huchard, found, in the beginning of the disease, an augmentation of fibrin in the blood, which, in the course of the disease (on the seventh day), had reduced to half of the normal proportion. Huchard states further, that Damourette noticed the missing of the two normal hæmoglobin rays in the blood of variola patients on spectroscopic analysis.²

To maintain systematic unity it would have now been proper to enter upon the description of the variola pustule. It is, however, of eminent importance to view the processes transpiring in the human organism, in their intrinsic nature, on which the formation of the pustule upon the exterior is dependent, as a matter of consequence, it would thus behoove us to revert to some of the morbid alterations above enumerated, that are the antecedent causes of those morbid processes, of which the variolous eruption is the outward phenomenon. Moreover, to compare them with analogous processes instituted by experiments, in order to arrive at some data tending to indicate the chronometrie duration for and the degree of the formation of structural changes of those organs here referred to; and, again, to draw comparison with the effects upon those organs by the alleged "infectious contagion." The serious nature of the structural changes above described, will probably not be disputed and require to be admitted, to indicate that their period of development is far greater in duration than can be allotted them in accordance with the mathematical problem of "infection" or "contagion." Those of the kidneys, in particular, may have required months for the degree of development which they exhibit in autopsy. They are found to have undergone an organization of the lardaceous kind, and,

(1) Coze et Feltz, l. c., p. 207.

(2) Mort dans la Variole, pp. 12-15.

as is well known, in the morphology of tissue, this would be the third step in the formative process, (viz: 1, plasmatic; 2, mucinous and amyloid; 3, lardaceous,) thus their origin is of older date than is embraced by the period of "incubation" and "stadium prodromorum" (13-17 days),¹ as will directly be proved by the evidence submitted from experiments. But before submitting this evidence it is of importance, on this occasion, to allude with emphasis to the fact already mentioned, viz: variola blood containing *double the amount of urea* contrary to normal blood, for the bearings of this fact in this connection may bring it more energetically and lastingly to recognition.

Experiments on rabbits, instituted by Baudouin,² bear proof that no structural changes of the liver, kidneys, etc., have taken place after an elapse of 15-16 days that the animal was injected with variola blood, these organs were merely congested and only the epithelium manifested a fatty (oily?) alteration (degenerescence grasseuse.) In dogs, into the crural veins of which putrid matter was injected, the kidneys appeared but congested, upon autopsy being resorted to thirty-six hours after death, and which had taken place four days after the first injection.³

Now, Niemeyer asserts⁴ that from date of "infection" to date of prodromous symptoms—stadium invasionis—the system would remain unmolested, and morbid effects can hence only be expected to take place from the date of the fever—four days prior to the eruption. However, as death occurs, in the great majority of cases that terminate fatally, in the stage of suppuration and desiccation, the period of time which could thus be allowed for the development of the morbid structural changes could not exceed 12-16 days.

On inquiry into the previous history of variola patients it will be learned that their health had begun to decline for a long time previous to the date of "incubation," leading to the inference that the structural changes in the kidneys were in their incipency.

The lesions of these organs evidently constitute the fundamental basis in the elaboration of the material essential for the small-pox process: they are of gradual development and long duration, greatly exceeding that period fixed by the theory of "specific infection."

(1) Comp. Ziemssen, Greifswalder Beiträge, p. 171. Niemeyer, l. c., allows but from 10-14 days, and Laboulbigne from 12-15. L'Union Médicale 7, et 8, November, 1868.

(2) Quoted by Coze et Feltz, pp. 186-206.

(3) Virchow's Arch., Vol. XLVI, p. 90.

(4) L. C. p. 346.

If now attention may be invited to the manner in which urine is elaborated, the ætiological momentum, viz: the double proportion of urea in the blood grows to the full magnitude of its nosological bearings. Physiologists seem to agree upon the admission that the solid constituents of the urine are elaborated by the epithelium in the convoluted tubuli uriniferi, and after the aqueous substance is absorbed, which is elaborated by the malpighian tufts, the urine being then normally formed. It is thus quite apparent that slightly limited structural changes lead to the retention of the elements of urine, of which the proportion must increase as other emunctories fail to perform their functions that otherwise compensate the action of the kidneys. A general contamination of the circulating fluids (azoturia) would thus be an inevitable consequence, attended with displacement of oxygen from the blood corpuscles, an augmented proportion of carbonic acid in the blood, and followed by the predominant alkalinity of the blood and lymph, which is universally observed in diseases of dissolution.

The albuminuria, so frequently observed in patients suffering from eruptive diseases, and in small-pox patients in particular, admits now of a very rational explanation, and its occurrence only corroborates the existence of the lesions above indicated.

The opinions here expressed, it is gratifying to state, fully agree with the observations made by the late Professor Watters,¹ when discussing the causes of scarlatina in his usual profound and logical manner, February, 1870. He also admitted uræmia (azoturia) to precede the eruptive fever, and explained the attending albuminuria in a manner similar to this here given.

Before proceeding further it also behooves us here to revert to that remarkable state of entire destruction of the supra-renal capsules; to consider, though but cursorily, the mode of its occurrence and the consequent effects upon the system.

So far as physiological knowledge enables the physician to detect the injuries of the blood, arising from a non-separation of the elements of urine, it is now understood that from the decom-

(1) In memoriam of Dr. Watters it needs be said that his genius ranks among the most illustrious ones on the medical firmament; his attainments in medical science stand pre-eminent; and by the intellectual inheritance which he has left us, he is immortalized.

To these sentiments of veneration and devotion expression is given not from "*de mortuis nil nisi bonum*," nay, in a conventional sense, he was not without faults, (and who is without any?) but from a sense of duty and self-justification; not also to accord in the humiliating tendencies to doom him to oblivion. He was a beacon light in physiology and medical philosophy.

Spectemur pro virtutibus.

position of urea and uric acid in the blood and lymph carbonic acid, ammonia, and carburetted hydrogen result, and that any one of these substances reacts destructively on the hæmoglobin,¹ displacing so much of the equivalent proportion of the oxygen that the organization of the blood corpuscles, with which contact has occurred, is broken up,² and the remaining component parts must be eliminated as effete substance. The constitution of the blood is thus altered (by precipitation of the fibrin from the blood corpuscles), and, owing thereto, "abortive organizations" or regressive neoplasms will result, which can, in the beginning, not be distinguished from the normal formations.³ In consequence of their fibroplastic construction and regressive character, they form the "fibrinous ferment" infiltrating the capillary vessels, and the normal blood then will suffer—as a matter of consequence—coagulation, for "*the coagulation under influence of blood containing fermenting substance occurs particularly in the capillaries of those organs in which the blood corpuscles are actively converted.*"⁴

From histological research the fact is ascertained that the supra-renal capsules appertain to that class of organs which have the highest degree of blood circulation⁵ and thus, according to their glandular functions, reconvert proportionately ready-formed blood into primitive (protoplasmatic) compounds. With an azoturic admixture these compounds tend to the regressive metamorphosis.

In reference to these facts it may be of importance to state that "by means of the disintegration of white blood corpuscles, and even more so of the transition forms already colored, the fibrinous ferment and fibrinoplastic substance originates, and if both of these substances enter the general circulation, that an affection ensues, which resembles a sepsis entirely:"⁶ further, that "in man putrescence causes a softening in the interior of the cortical layer" of the supra-renal capsules.⁷ Moreover that the height of the fever temperature manifested by the patients, is based on and is proportionate to the disintegration of tissue elements,⁸ and that "*from fibroplastic thrombi a*

(1) Comp. Preyer, Pflüger's Arch. d. Physiol., Vol. 1, p. 395 et seq

(2) Comp. Pflüger, ibid, p. 77.

(3) Karsten, Fäulniß und Ansteckung, p. 8.

(4) Kochler, Fibrinfermente, p. 92. Comp. also Samuel, Virchow's Arch., Vol. 51, p. 67

(5) Stricker, Lehre von den Geweben, p. 514.

(6) Kochler, l. c., p. 107.

(7) Stricker, l. c., p. 510.

(8) Oidtman, Zwangs-Impfung, p. 77.

general infection may arise, pursuant to the fibrinous ferment therein contained, and may lead to death in man and animals."¹

After the morbid changes or structural alterations of the internal organs have been related, their interrupted or perverted functions being indicated as the primary condition for the development and augmentation of the material essential to and actually engaged in the process of small-pox, and the adduced evidence proving the beginning of these changes to precede for a long interval the period of "incubation," and that of the fever and eruption, it would therefore be proper for us now to advert to the territorial diffusion, and to the anatomical and histochemical character of the variola pustule.

The instructive and highly important fact pre-eminently demands recognition, that the pustular eruption is only met with upon surfaces to which atmospheric air has access, and the law upon which the occurrence is dependent, equally as urgently requires to be understood. If, therefore, it may be remembered that double the proportion of urea is found in the blood of small-pox patients, and that on its account a septic decomposition with the evolution of ammonia² ensues, giving rise to a hyperalkalinity of the circulating fluids; oxygen is thus eagerly attracted³ and certainly, but there where the relations of chemical interchange afford the greatest facility. The localities where the vesicular eruption is found, are: the entire surface of the skin; the mucus membrane of the mouth, pharynx, trachea, bronchial tubes—to some extent below the bifurcation—the inferior segment of the vagina, and the orifices of the urethra and rectum.

The cornea, sometimes, is the seat of a variolous pustule, which, though, is more correctly to be considered an abscess, (no opportunity for post mortem examination was available in which one could make minute or differential investigation,) but in no instance are pustules found upon the conjunctivæ, although every patient admitted to the hospital, from January 16 to April 1, 1870, was carefully examined and his clinical history for this purpose especially recorded; attention to the same fact was already invited by Gregory,⁴ and who on this subject is high

(1) Kœhler, l. c. p. 104.

The greater mass of emigrating corpuscles or cells enter the lymphatic vessels (for distribution) and emboli (enfarcion) following thereupon in blood vessels, naturally lead to the formation of pus. Cohnheim, *Embolische Processe*, 1872. pp. 37 and 103.

(2) Beck's *Med. Jurisprudence*, xii Edit., Vol. II, p. 450.

(3) Hoppe-Seyler, *Chem. Analysen*, pp. 108-9.

(4) *Cycl. of Pract. Medicin.* Lond., 1831, Art. "Small-pox."

authority. In explanation of the reason, it may be said that the tears, washing the conjunctivæ, contain .04 of chloride of sodium, and that by the physiologico-chemical influence of this salt a septic oxidation (putrefying decomposition) is avoided.

Pustules forming upon a mucus surface do not develop to the same degree of perfectness that they do upon the cuticle in the form commonly designated "discrete" or "distinct," and this seems to be owing also to the presence of chloride of sodium in the secretions of mucus, (certainly though in a reduced proportion in this sickness,) thus constantly bathing the pustule in a neutralizing medium, and dissolving its epithelium.¹ Consequently when those portions of the membrane forming the coating or cover of the pustules are necrosed, they present a perfect similarity to those of the skin, especially in the "pasty confluent" form. At last, by the regressive process of oxidation, they decompose and putrify alike, owing to the equal and immediate access of the atmospheric oxygen, so that, finally, they present on microscopic examination an oily decayed mass, fully resembling that of putrid cheese.

In the skin the eruption can be studied with more facility, owing to the greater accessibility, and the fact that the phases of its transformations are not so materially interfered with. Though but little can be added to the brief and concise description, given by Bærensprung, copied by Niemeyer,² where the anatomical changes are faithfully enumerated—from the incipency to the final termination. However, in view to advance rational explanations of the principles upon which the observable local changes in the cutis are dependent, characterizing the small-pox pustule, it would seem requisite again to review the subject, and to append such additions as will either correct apparent errors or make up deficiencies, without which the ontology of variola would remain fragmentary and in many respects contradictory.

Before proceeding to the description of the individual pustule, a momentary interruption in the course of our narration, it is hoped, may kindly be tolerated, as it is unavoidable in justification of a priority in authorship. Further, especially, as the doctrine based upon the evidence thereby advanced, first, by me, and already in 1870, disproving the asserted "specific" and "infectious" nature of variola. I find my statements, in reference to the idea further above already intimated (p. 15), that

(1) Comp. Valentine, *Grundriss d. Physiologie*, p. 285, § 88o.

(2) *L. C.*, Vol. II, p. 543.

only homologous histological elements are found in the small-pox vesicle, and that their heterologous character is only found to exist in the territorial diffusion or distribution of tissue to which they are irrelevant, re-represented and embodied (modified so as to give cast to the "cellular" doctrine), in the treatise on small-pox by Dr. Curshman, of Berlin, in Ziemssen's *Cyclopedia of the Practice of Medicine*, Vol. II, pp. 382-3-4, published by Wood & Co., N. Y., 1875, under the name of a different author. I cannot avoid here entering protest against a literary unfairness. My treatise contained the first elaborate and minute anatomical¹ and histo-chemical description of the variola vesicle and pustule (so far evidence could be gathered from accessible literature), and was the result of most careful and diligent research, extending over a period of three months, during an epidemic, and embracing more than two hundred separate examinations.

Again, I beg to mention, to anticipate an apology which could possibly be ventured as not having been aware of the existence of my treatise, that in 1874 I mailed to Dr. Pissin, in Berlin, copies of my pamphlet, after having read his work on "The best method of vaccination," wherein I found Dr. Curschmann's name mentioned in connection with the subject of vaccination, with the special request to transmit a copy to Dr. Curschmann.

After these explanatory remarks, I shall now reproduce, in double column, the description of the variola pustule, as given in the original or first edition of this treatise, and parallel with it that given by Dr. Curschmann, in order to submit the subject to impartial judgment.

MY STATEMENT.

1870.

"With propriety, Bærensprung observes: The primitive changes of the cutis are circumscribed hyperæmia, designating the topography where the consecutive pustules are localized. In connection with these facts it is highly important to bear in mind the anatomy of the skin. The blood-

DR. CURSCHMANN'S STATEMENT.

1875.

"The first trace of the pock, a simple red spot, is produced by a circumscribed hyperæmia of the papillæ, which (according to Bærensprung), is continued through the entire thickness of the cutis. The papula which is formed in the place of this red spot is produced by a peculiar change in the epider-

(1) The essay of Auspitz and Basch (*Virch. Arch. Bd., 28*), mentioned by Dr. Curschmann, was and is yet unknown to me.

vessels are well known to ramify in the Malpighian papillæ of the corium, and the conelike projections of these papillæ extend in but a limited space to the surface (only being covered by the rete mucosum and epithelium.) From the anatomical relations here indicated, the occurrence of the hyperæmia, the first noticeable morbid change in the cutis, can readily be understood by recognizing the elementary substances, already indicated, in contact with the blood, causing a displacement of the oxygen and decomposition of the blood corpuscles, ending with an expansion of the volume of the blood and thus engorging the capillaries.

“The next stage of the eruption is, what is termed the papulous. According to Bærensprung these papulæ are at first perfectly solid, but, consecutively, exudation takes place into the surrounding tissue. However, from our own observation, it appears that transudation of serum—the exudation—occurs simultaneously with the formation of the papulæ; when the cuticle is gently scraped with a sharp scalpel the fluid, then exuding, resembles serum, and exhibits, on microscopic examination, with a power of 480 diameters—Hartnack, system 7, ocular 4—in addition to blood corpuscles, dissi-

mis. It differs from other papulæ, which are due to circumscribed swellings of the cutis; if we examine a papula, we find the cells of the rete Malpighii enlarged and granular, especially the cells situated between the outer epidermis and the layer of cells immediately covering the papillæ. By the swelling of these cells the outer layer of epidermis is pushed up, and flat, solid papulæ are formed. The next step is an exudation of clear fluid from the papillary layer; this fluid separates the altered cells spoken of above, and lifts up the outer epidermal layer. Thus the papula is converted into a vesicle. The vesicle then becomes larger by the continual exudation of lymph and the swelling of more cells. The exudation does not, however, separate the altered cells from each other. They are separated into small groups, which are compressed by the oxidation in membranous and fibrous forms until they look like a network infiltrated with lymph and filling up the cavity of the pock. The epithelial character of this network can be made out in every part, notwithstanding the alteration of the cells by pressure and maceration. This view of the real nature of the network in the pustule is one of the most important advances in the histology of small-pox.

milar corpuscles, of which some have granular contents, others are merely colorless spheroids, without any granules or nuclei.

"The solution of this problem is materially aided by the universally appreciated observations of Cohnheim.¹ He observes: Upon ligating the femoral vein of a frog, the blood in the capillaries, in consequence of the stasis, changes its physical character, so that the arterial blood assumes a bluish hue, analogous to the venous blood. The volume of the vessels conspicuously increases, and transudation—i. e., emigration of blood corpuscles² follows after a lapse from 45 minutes to several (10–12) hours; but when the ligature is removed or loosened and the current restored again, the normal color also returns.

"Readverting to the previously made observations, viz: That the discoloration of blood is owing to the displacement of oxygen from the corpuscles, in consequence of the expansion of gases, [evolved by regressive oxidation and augmented by the energetic attraction of oxygen or ozone from the sur-

While these changes are taking place in the epidermis, the corresponding papillæ become swollen and infiltrated with serum, while their blood-vessels are dilated, torturous, and surrounded by new cells.

"In many pocks, as has been said before, soon after the formation of the vesicle, and advancing with it, a *central depression* or "*umbilicus*" is seen. This central depression usually occurs in pocks in which a hair follicle or the duct of a sweat gland can be seen. Since the epidermis is continuous with the sheath of the hair follicles when a vesicle is formed about such a follicle, its center will be held down, and the surrounding epidermis will be more elevated than in the portion continuous with the hair follicle. The ducts of the sweat glands have the same relation to the epidermis and act in the same way in holding down the centers of the vesicles—(Rindfleisch.)

"In a pock where there is neither hair follicle, nor sweat gland, it is evident that some more resistant portion of the tissue may in the same way hold down the center of the wall of the vesicle. Auspitz and Basch explain the formation of the umbilicus in another way. They teach that the periphery of the pock swells more

(1) Ueber venöse Stauung, Virch. Arch. Vol. XLI, p. 220 et seq.; further: Embol. Proc., p. 28-57; and Entzündung, pp. 62, 63 and 66.

NOTE.—A priority of fourteen years is claimed by Dr. F. Keber, of Danzig. Comp. Virch. Arch., Vol. XLIII.

(2) Also comp. Virch. Cell. Pathol. 4th Edit., p. 399.

rounding media, owing to the hyper-alkalinity of the circulating fluids, and the fact that these gases permeate membranous tissue pursuant to the law of diffusion of gases toward the exterior for equilibration, and thereby constituting the chemico-physical motor (characteristics) or the *causa movens* in the formation and determination of the pustule.^{1]} The difficulty tending to prevent the proper understanding of the variolous eruption, can easily be overcome by an intelligible interpretation and rational explanation of the process, and to which the key is found in Cohnheim's observations. They perfectly elucidate the manner in which the primitive (histological) processes occur, resulting in the formation of the variolous papulæ and vesicles, and simultaneously prove that these are the physical laws upon which their determination as well as that of the results of his experiments are dependent. Illustrative proof, in verification of the truth of the assertion, is afforded by two parallel experiments: In one the normal color of the blood returned upon loosening the ligature of the ligated vessel, thus restoring unincumbered circulation, and reconveying proper quantities of oxygen to the corpus-

rapidly and thus becomes more voluminous than its center.

"When the pustule is fully ripe the umbilicus disappears by the stretching or destruction of the tissue which held down the center of the vesicle. When desiccation commences, an umbilicus may again appear from the earlier drying of the centers of the pustules. This also takes place in pustules in which there was before no umbilicus. When the pock is full ripe, the subjacent papillæ, which were at first swollen, become flattened. This condition may remain after the scabs have fallen off, and then give rise to shallow depression in the skin. But these depressions are quite different from cicatrices. In confluent variola, sometimes in the discrete form, and occasionally in varioloid, the papillæ beneath the pustules become involved in the inflammation. Pus cells accumulate in these papillæ, compress the blood-vessels, and produce partial or total necrosis of the tissue. This condition is indicated by great swelling and congestion of the skin around the pustules. We find in the latter, besides pus cells, fragments of the destroyed papillæ. But some portions of the papillæ may still remain alive, and thus hold the scabs on for a long while. The extent of the ulcers formed by

(1) Sentences in brackets are additions of recent date.

cles that suffered partial decomposition (displacement of the oxygen) in consequence of the stasis — (Cohnheim.) In the other, dark blood was shaken with atmospheric air in a cylinder, when its color also changed to the scarlet hue. [Cohnheim further found that in proportion to the duration of stasis in blood-vessels, the discoloration was followed by diapedesis (emigration? of the blood corpuscles), and this to change into the formation of pus.]¹

“In the variola vesicle the processes leading to the formation of pus precisely correspond with those in which pus formed in physiological experiments: First, stasis in the circulation and discoloration in the skin (hyperæmia); secondly, transudation (emigration of the blood corpuscles) and infiltration of limpid fluids into the surrounding tissues (Malpighian papillæ and cutis); and, thirdly, the formation of pus corpuscles of these fluids.

“At the period of infiltration (the formation of the variolous papulæ) the serum contains colorless bodies, which are all converted into pus corpuscles when the papulæ pass into the vesicular, and thence into the pustular stage. Testing the serum from the papulæ with test paper, even if the quantity barely moistens the paper, an alkaline reaction is perceptible; but if small portions are evaporated (on the microscopic object glasses over a spirit lamp), no crystals of urate of soda can as yet be discerned.

this destructive process determines the extent and shape of the cicatrices.”

(1) Comp. Cohnheim, Entzündung, pp. 63 and 66.

Virch. Cell. Path., 4th Edit. p. 531.

NOTE.—Huchard l. c., p. 12, tables, exhibit variolablood to have reduced 25 per cent. of the corpuscles (globules.)

“In the vesicular stage, the intermediate form of the papulous and pustular and as long the fluid is translucent, in addition to the non-granular and colorless (lymph-like) corpuscles,¹ numerous pus corpuscles are observed, granular and with ragged edges; the reaction of the lymph on test paper is decidedly alkaline. When the contents of the vesicle are about to change into opacity, portions of the fluid evaporated on an object glass and examined under the microscope, exhibit an abundance of urate of soda crystals.

“Whenever the vesicle has formed, upon removing the epidermal cover, the Malpighian papillæ are still very prominent, surrounded with a mass of whitish substance (the pseudo-membrane of Hunter), which imparts to it the appearance of a central excavation, and the space intermediate from the Malpighian papillæ to the epidermal cover is filled with serous fluid and broken down tissue particles from the rete mucosum, which is dissolved.² By injecting such vesicles with a solution of chromic acid, to harden it, then making a vertical section and examine their construction, *occasionally some fasciculi of fibrous tissue are noticed, conveying the idea that the interior of the variola vesicles and pustules is constructed similarly to the interior of an orange.*³ But these are exceptional occurrences, and whenever met with, require a great deal of poetical conception in order to be thus interpreted.

“The next following stage is designated the pustular, by which is intended to express the condition when the vesicular contents have become puriform. Examining this puriform substance microscopically it is found to consist chiefly of granular corpuscles of which mostly all have ragged margins. By using high powers—Hartnack’s system 10, ocular 4 or 6, 1200 and 2400 diameters respectively—the granules present a transparent yellow centre and thick dark outlines, characteristic of carbonate of lime.⁴ The pustule now presents what is termed the “umbilicated” central depression, said to be due to a hair follicle fastened in the centre of the pustular cover, and by the distention of the pustule the follicle would retract, thus causing the central depression.⁵ But in no single instance, of our own observations,

(1) They are now more minutely described by Cohn, see Curschmann, Ziemssen, l. c., p. 381; also, see Keber, Virch. Arch., Vol. 42, Pocken-Lymphe.

(2) Alkaline fluids dissolve the rete mucosum. Todd & Bowman, l. c., p. 362.

(3) Italics are resorted to in this edition for the purpose to compare with Dr. C.’s notation.

(4) Beale, l. c. p. 87.

(5) Simon, Muller’s Arch., 1846, p. 168.

could these assertions be corroborated. On the contrary, when a portion of skin with umbilicated pustules is dried and vertical sections are made, carried through the margins of the pustules, in order to be enabled to look through them, only an arched vacant space is visible with no structure of any kind in it. It is hence evident that the umbilical depression is not dependent on special anatomical provisions, but on physical causes.

"It may be learned from description, but far better from observation, that the variolous semi-spheroid maintains a flattened conical form as long as it is translucent, but with the moment opacity sets in the umbilicated central depression is perceptible. Now, in the process of the formation of pus or decay, ammonia is evolved,¹ a fact which will be corroborated by other facts emanating from the subject here under consideration, and is the more important as thereby the phenomenon of the umbilicated central depression admits of a rational explanation.

"As already observed, in the transparent state of the 'vesicles' (serous contents) crystals of urate of soda predominate, but in the opaque state of the 'pustules' (pus contents), granules of carbonate of lime are observed. These data clearly indicate that the uric acid of the urate of soda is converted into ammonia and carbonic acid, and its principal portion having escaped in form of gases, by permeating the cover of the pustule (gases permeate membranous tissue, particularly when softened), thus the volume of the pustular contents is reduced, and subsequently, by the pressure of the surrounding atmosphere, the centre is depressed and the umbilicated pustule is produced."²

The confluent and cruentate (hæmorrhagic) forms, probably, do not require any farther description; they are the same disease,

(1) Beck's Med. Jurispr. l. c., Further comp. Gorup-Besanez Physiol. Chem., p. 83-89 and 415, pus cont. urea; also comp. Claude Bernard, *Leçons sur les Phénomènes de la Vie*, Paris, 1878, p. 175, where it is stated that the products of putrefaction are ammonia, carbonic acid, sulphuretted hydrogen, hydrogen and "azote." These substances go back again to the atmospheric air.

(2) These data eminently deserve further attention in clinical observation and in the researches of physiological and pathological experimentation (especially comparing the different results when the access of the atmosphere has been excluded from some of the vesicles.) Also in ethnographical description with reference to chorological distribution of man and the character of his diseases, etc., in what altitude—i. e., under what degree of barometrical pressure the umbilicated depression in the variola pustule is not noticed any more, or small-pox cease to exist. Efforts similar to those entered upon by Hirsch, *Handbuch der Historisch-Geographischen Pathologie*; by Fuchs, *Medicinische Geographie*; or those by Griesbach in reference to Botany, *Die Vegetation der Erde*, would in future prove of capital aid toward a correct understanding of regional embryology, or rather chorological ontogeny of disease.

NOTE.—In the quotations of the text, in a few instances, the wording has been changed but not the sense of the original sentences, unless indicated.

only differing in degree of intensity or severity, the morphology of the discrete (distinct) form will also apply to them. In the verrucose (nodular) form, a few additional points of interest may be noticed. Upon fresh surfaces, made by vertical sections, they present, under the loupe, the appearance of a solid cone—no cavities and no pus formed in them. The material which exudes from the vessels of the malpighian papillæ seems to possess organizable property, or at least the power to resist destructive oxidation (putrescence), which visibly follows the absorption of the atmospheric oxygen in the vesicular and pustular forms. The serum which sparingly exudes from these surfaces presents, under the microscope, well defined colorless spherical (lymph?) corpuscles, and after evaporation frequently exhibits minute, however distinct, crystals of chloride of sodium. These data evidently warrant the inference that the system in this form of eruption has not suffered any material reduction of the normal proportion of chloride of sodium, because the “vital” properties of the plasma in the nodules are maintained, owing, as is well known, to the reaction of this salt, and thus the albuminates remain in solution; the destructive influence of oxygen is thereby counteracted and its combination with albumen converted into oxides, which are the essential ingredients to the formation of protoplasm in the progressive (constructive) scale. The preserving property, or the modifying influence exercised by chloride of sodium over destructive oxidation of animal (albuminous) matter is well exemplified by the salting or pickling of meat, rather a less elegant illustration, but the observations of Cohnheim and of Binz, made in their experiments with chloride of sodium and chlorates, evidently corroborate the adduced validity of the exemplifications, only by more acceptable testimony in the verification of the point here under consideration, viz: to the reaction of chloride of sodium, which continues to circulate in the nodule, is to be ascribed the vivacious termination of eruption in variola verrucosa. Further above it has already been stated that chloride of sodium possesses solvent powers over albumen, and owing to this property it regulates the vital employment of oxygen. The fact is beautifully but most strenuously illustrated by the experiments of Cohnheim, made on frogs. This eminent author injected frogs with a solution of chloride of sodium of 0.75 (concentration) to that extent that all their blood was displaced—made to escape by counter openings in other veins—while the injected solution circulated in their blood vessels. A number of the animals thus experimented on continued to live for

three days.¹ In conducting the experimentations of pharmacological studies on quinine and its preparations, Binz² found that the preparation which possessed the power to resist decay, putrescence and fungus growth was the *hydro-chlorate*.

According to the various facts above intimated, it is undisputably true that the phenomena observed in variola verrucosa are owing to the reaction of chloride of sodium present in the circulating fluids, that consequently the process of absorption is not morbidly altered, as albuminous coagula are redissolved, and the skin re-assuming gradually its smooth appearance again. Moreover, the histo-chemical evidence may thereby also and conclusively be demonstrated that *the degree of intensity of any one of the forms of variolous eruption is on a ratio to the displacement of chloride of sodium from the circulating fluids*.³

PROPHYLAXIS.

The conclusion would seem but a logical inference, that now, after the demonstration of the histo-chemical origin and physical nature of variola, the presumptive value of vaccination—as a protective means against this disease—be fully disproved. But as the “magic effects” of this sanitary (?) measure are continually proclaimed, and with great ostentation, nearly the entire civilized world, in open conflict with all reason, is engaged in its behalf in an unlimited laudation, is conquered by a triumphant enthusiasm and with implicit faith, acknowledging vaccination “the greatest boon ever bestowed upon mankind,” and to adduce thus statistical evidence appears to be indispensable. But philosophers have deemed it wise to allow exceptions to rules, and the admirers and followers of the dogma of vaccination have found it expedient to avail themselves of the practical application of this maxim, for *statistical* data indicate a decided difficulty in discriminating between the “rule” and the “exceptions.” The original omnipo-

(1) Virch. Arch. Vol., XLV, p. 333-9; Embol. Proc., p. 51.

(2) Virch. Arch., Vol. XLVI, pp. 74-76.

(3) Comp. Both, l. c., p. 49.

tency of vaccination¹ has, under the focal light of scientific inquiry, become reduced "to quite an unreliable means," for re-vaccination and repeated vaccination is now recommended, and even then with but the humble claim that:

1. In consequence of vaccination small-pox epidemics occur now less frequently, their severity and magnitude are more limited, and the mortality thereof is diminished.

2. Vaccinated persons do not take the true pock any more, but only the modified—i. e., a changed type and less severe; eruption and prognosis take a lighter course, and mortality is markedly reduced in comparison with those not vaccinated.

3. Vaccination (may) protect man against small-pox for his lifetime.

4. Proof in support of the foregoing propositions is afforded by the statistics of all nations and of all periods of time.²

In answer to the first of these propositions, it would suffice to invite attention to the statements already given under the head of *genius epidemicus*, where, probably beyond dispute, the evidence is produced proving that *variola* epidemics are dependent upon physical influences which certainly cannot be influenced by vaccination. But as frequently most palpable facts are doubted, statistical data shall now here be adduced bearing testimony in both directions: first, that vaccination is devoid of protective power; and second, also devoid of the modifying effect.

On this continent the great general rule may be received as an established fact that, namely, two-thirds of the population were, so called, lawfully vaccinated, and one-third has never been vaccinated; and that *variola* statistics, however, exhibit two-thirds of the cases registered of those previously vaccinated, and one-third registers as never being vaccinated. On the European continent *variola* statistics, even more directly contradict the assertion of the protective influence of vaccination, as there non-vaccinated cases are but exceptional. But the reason why non-vaccinated cases are exhibiting, comparatively, a severer degree of intensity and a larger per cent. of mortality, may be found in two facts. The first is: *non-vaccinated persons*, as a rule (nearly to the present day) *could neither comply with other sanitary rules, as they number, nearly exclusively, among the needy proletariat.*

(1) Sacco caused a small-pox epidemic to cease, by means of vaccination, instantaneously (mit einem Schlage), see Pissin, p. 50; and Snow saw small-pox stopped four different times in one winter, also by means of vaccination, in the city of Providence, R. I. See *Med. News and Library*, August, 1870, p. 119.

(2) Reproduced from Gottschall's *Essay, Keine Jumpfung mehr*, p. S.

The second is: *infant children*, too young to have been vaccinated; *possess not sufficient resistance against the destructive reaction of the small-pox process.*¹

In accordance to the previously adapted maxim, the domestical statistics may be introduced first, and principally for the reason that they can be vouched for by having fallen under personal observations.

As previously already stated, the entire number of small-pox cases admitted to the small-pox hospital of this place, from November 1, 1869, to May 1, 1870, was 326, and the number reported by the health officer from the city was 185, making a grand total of 511. Of this number were previously vaccinated, 336, and the number never before vaccinated was 175.

To tabulate the number of cases from the hospital, according to the degree of severity, the following data are produced:

Vacc. cases.		Non-Vacc. cases.	
Confluent malignant.....	9	Confluent malignant.....	17
Confluent.....	55	Confluent.....	54
Distinct.....	90	Distinct.....	40
Varioloids.....	55	Varioloids.....	6
Total.....	209	Total.....	117

These limited statistical data alone would seem sufficient to invalidate the assertions of the four propositions upheld in favor of vaccination, but to force the world to acknowledge their maintained errors, proof on a more extensive scale may further be adduced.

In Sweden, prior to the introduction of vaccination, in 1801, died of small-pox, 600 persons per one million inhabitants,² and since vaccination has been assiduously practiced there,³ the mortality of small-pox has gradually but regularly increased. In 1874, with a population exceeding but little the number of four millions, there died of small-pox, in this state, 4,063, exhibiting thus an *increase* of more than 400 per million inhabitants.⁴

When the question of transmission of syphilis with vaccination was receiving profound attention by the medical fraternity, it was simultaneously stated that "humanized" vaccine matter had degenerated, as it was found not to protect against small-pox any

(1) Vacher found the mortality in the first year of life ten times greater than between twenty and thirty. *Med. News and Library*, June, 1870, p. 94.

(2) Gottshall, l. c., p. 8.

(3) In Sweden vaccination is obligatory, and is under direct supervision of the government.

(4) Oidtman, als Impfgegner vor dem Polizeigericht, p. 99.

more, and the assertion was advanced that this protection was again secured by employing vaccine lymph directly from the heifer. Pursuant to this the French government instituted this mode of vaccination in the city of Paris in the spring of 1870, and the Municipal Council of Paris voted 10,000 francs for the organization and a system of gratuitous vaccination. The inhabitants of Paris availed themselves of this opportunity to a great extent. "On one morning as many as two thousand persons presented themselves for vaccination at one *maire* alone."¹ But what has been the result? Those thus vaccinated and revaccinated contracted small-pox in the same way as all others, who were differently or not at all vaccinated. The *conseil d'hygiene et de salubrite* rejected it already in December of the same year.² The reason for this action may satisfactorily be learned from the following table, which states the deaths from small-pox in Paris in each of the months of 1870 and the first three months of 1871:

1870.

January	174
February	293
March	406
April	561
May	786
June	914
July	1,072
August	713
September	700
October	1,361
November	1,722
December	1,837

1871.

January	1,503
February	763
March	230

As early as February in 1870, vaccination and revaccination directly from the heifer was put in operation in Paris, so that to the month of October six to seven months had elapsed and consequently the protective power of vaccination ought to have been at the very height of its potency, but alas, instead thereof the table exhibits an alarming increase from October to the end of December.

The entire number of deaths from variola during the fifteen months specified by the table is 13,035, being more than twenty

(1) Med. News and Library, Apr., 1870, p. 62.

(2) Colin, p. 105, note.

times the number that occurred in the years, embracing a period from 1860 to 1870-1. The table reads as follows:

Years.	Deaths from Variola.	Years.	Deaths from Variola.
1860.....	328	1866.....	615
1861.....	549	1867.....	301
1862.....	476	1868.....	655
1863.....	348	1869.....	723
1864.....	384	1870.....	10,539
1865.....	740	1871.....	2,496 3 mo.

During all these periods vaccination was practiced and small-pox, comparatively speaking, remained stationary, when again and after the greatest efforts were exerted in securing in the most attainable efficacy of vaccination, the disease rose to a height not before experienced at Paris.

In England, the nursery of vaccination, where, in London alone, in the year 1871, the number of deaths from small-pox is registered to be 7,876, and notwithstanding the "potential efficacy" there exercised by the compulsory vaccination law, yet, according to the natural laws that govern epidemics, in one week, ending May 6th, 288 deaths from this disease had taken place.

How rigorously vaccination is practiced there may be learned from the following table:

Years.	No. of persons success-fully vaccinated.	Rate per ct. of the No. succ. vacc. to the No. of births.
1852.....	397,128	66.0
1853.....	366,593	60.0
1854.....	677,886	108.7*
1855.....	448,519	72.0
1856.....	422,381	69.9
1857.....	411,268	63.3
1858.....	455,004	69.5
1859.....	445,020	66.4
1860.....	485,927	70.5
1861.....	425,739	62.1
1862.....	437,693	62.3
1863.....	646,464	89.7
1864.....	529,479	71.6
1865.....	578,583	77.9
1866.....	454,885	60.0
1867.....	490,598	64.0
1868.....	513,042	66.5
1869.....	524,143	67.3
1870.....	472,881	60.0
1871.....	693,104	87.4

(*) Year of the operation of the "act 16th and 17th, Vict. cap., 100. Comp. Report of Local Government Board, 1871-72, p. 516; and Annual Report Board of Health, N. Y., 1871, p. 191.

In Wuerttemberg where vaccination has been practiced since the introduction of the Jennerian method, and in such thorough manner that but "one has escaped vaccination in 600 to 700 persons." To illustrate how vaccination may have succeeded in preventing small-pox, the table here reproduced, embracing the period from 1854 to 1868, and the number vaccinated during this period, 576,675, records startling data.

Year.	Cases.	Deaths.
1854-55.....	275	31
1855-56.....	103	8
1856-57.....	147	8
1857-58.....	90	6
1858-59.....	346	23
1859-60.....	189	16
1860-61.....	216	13
1861-62.....	136	9
1862-63.....	357	38
1864.....	2,764	160
1865.....	3,611	260
1866.....	2,593	235
1867.....	1,515	111
1868.....	559	34

Further to illustrate the relative frequency of the occurrence of small-pox prior to the introduction of vaccination in comparison to a period when vaccination was practiced on a scale of its greatest magnitude, a table of the comparative mortality of small-pox in the city of Stuttgart (Wuerttemberg), affords conclusive testimony of the presumptive value of vaccination.¹

Year.	Deaths.	Year.	Deaths.	Year.	Deaths.
1786.....	97	1796.....	286	1859-60.....	0
1787.....	2	1797.....	3	1860-61.....	0
1788.....	2	1798.....	158	1861-62.....	1
1789.....	179	1799.....	107	1862-63.....	11
1790.....	17	1800.....	35	1864.....	56
1791.....	1	1801.....	17	1865.....	33
1792.....	28	1802.....	1	1866.....	6
1793.....	103	1803.....	108	1867.....	0
1794.....	9	1804.....	13	1868.....	1
1795.....	11	1805.....	11	1869.....	50
.....	.....	.....	.....	1870.....	160

Could there be any more direct and potential statistical evidence to prove the futility of vaccination as protective means against variola?

To obviate the argument that lymph taken directly from the heifer, as was the case in Paris, may not possess so much of protecting power (strictly speaking, it would be no point of argument,

(1) Class. L. c. pp. 3, 50, 68 and 70.

as at present the heifer lymph is officially preferred to be employed) as "humanized" lymph, the history of the small-pox epidemic of 1871, and 1872, by which Philadelphia, Pa., was visited, may be alluded to, as vaccination has always been thoroughly practiced there, and with "humanized" lymph (because statements to the contrary are not made.)

Before adducing the data of the epidemic, it may be of interest to reproduce the table by which is exhibited the extent to which "successful" vaccination was carried previous to and during the epidemic, as public vaccination:

*Successful Vaccinations Performed in Each Year, from 1860 to 1872,
Inclusive.*

Year.	Cases.	Year.	Cases.
1860.....	5,313	1867.....	6,189
1861.....	9,251	1868.....	5,207
1862.....	4,026	1869.....	6,650
1863.....	4,028	1870.....	7,190
1864.....	4,809	1871.....	30,526
1865.....	5,652	1872.....	18,198
1866.....	3,556		

In the report it further is mentioned that "the large number of operations performed by the public vaccinators bears but a small proportion to the number performed by private practitioners. It is believed that vaccination was never more generally resorted to by our citizens than during the winter of 1871 and 1872."¹

To convey an idea what commonly the course of small-pox at Philadelphia has been, the figures of the mortality of this disease, commencing with year 1860 are, therefore, here represented. The years of the epidemic, 1871 and 1872, when vaccination and revaccination was carried to such an extent as never before paralleled at Philadelphia, exhibit the highest rate of small-pox cases since 1807.

NUMBER OF DEATHS FROM SMALL-POX ANNUALLY.²

1860.....	57
1861.....	758
1862.....	264
1863.....	171
1864.....	260
1865.....	524
1866.....	144
1867.....	48
1868.....	48
1869.....	6
1870.....	9
1871.....	1,879
1872.....	2,585

(1) Report of Board of Health, 1872, p. 87.

(2) Report of Board of Health, p. 121.

The duration of the epidemic of 1871-72 embraces but six months, and the number of cases occurring in these months was the following: 1871—October, 1,628; November, 2,944; December, 3,307. 1872—January, 3,130; February, 1,794; March, 1,247 (p. 118). It may further be opportune here to observe that the comfortably situated and healthily located portion of the population inhabiting 3d, 5th, 6th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 21st, 22d, 23d, 24th, 27th and 29th Wards escaped with insignificant minima, but the inhabitants of the 1st, 2d, 4th, 7th, 16th, 17th, 18th, 19th, 20th, 25th, 26th and 28th Wards, of which the report (p. 63) states “they contain over-crowded and badly ventilated localities, inhabited by a people morally and physically depraved, who set at defiance every sanitary law, and oppose and refuse all protective measures directed for the preservation of their health and lives,” furnished the great maxima. Tabulated the following exhibit is produced:

Wards with Minimum Mortality.	Wards with Maximum Mortality.
3.....82	1.....133
5.....91	2.....140
6.....20	4.....112
8.....29	7.....109
9.....24	16.....106
10.....28	17.....145
11.....68	18.....101
12.....39	19.....325
13.....33	20.....132
14.....36	25.....99
15.....78	29.....168
21.....16	28.....329
22.....23	
23.....27	
24.....59	
27.....28	
29.....50	

In Paris, 1870, similar observations were made—*Med. News and Library*, June, 1870, p. 94; also Berlin, 1871. The section “Friedrichstadt” one-fourth as thickly populated as “Wedding” and ten times wealthier than the last named section, exhibits but one-fourth of small-pox mortality per 1,000 inhabitants in comparison to other sections.¹

The facts set forth by results of vaccination in Philadelphia, may be considered fully corroborated by the data given by Monteils,² in a very elaborate table of sixty-four epidemics, chronologically arranged, and embrace the period from 1816 to 1870, when “humanized” lymph was, perhaps, exclusively in use. The total num-

(1) *Albu, Hygien. Topogr. Atlas*, vide Vogt, *Impffrg. und Statistic*, p. 37.

(2) *Histoire de la Vaccination*, table opposite p. 108.

ber of cases related by this author are 69,284, of which 26,569 were not vaccinated, 42,359 vaccinated and 356 had small-pox already before.

The sudden rise and equally sudden disappearance of small-pox in Paris and Philadelphia, and the great mortality among the suffering proletariat, must certainly be ascribed to other influences, and operations of other laws, than to the practicing or omission of vaccination, which must now be admitted even by the most inveterate vaccinator, as vaccinated or unvaccinated individuals are attacked alike—i. e., in their equivalent proportion. The epidemic of Berlin, 1871, reaching the alarmingly high figure of 14,358 cases, of which 4,218 died (Colin l. c., p. 10, and as to this fact Pissin l. c., p. 45 remains carefully silent), corroborates this fact, as in the State of Prussia not a single one can escape vaccination, for the Government executes the law, requiring the operation most rigorously to be performed. Also an epidemic in Altenburg, as reported by Dr. C. Becker-Laurich,¹ embraced the number of 164 small-pox cases, of which 112 had previously been vaccinated and 52 were unvaccinated cases. The reports of the general hospital of Vienna² from 1836 to 1856, give statements to the same effect. In this period of time 6,213 small-pox patients received attention there, of whom 5,217 had previously been vaccinated, and 996 not. Also in Wieden³ were, from August, 1858, to the close of the year 1864, small-pox patients admitted numbering 1,330, of whom but 20 had not previously been vaccinated.

The “modifying” effect to which the advocates of vaccination have now retreated, as their claimed “protective” influence of vaccination is in every instance disproved, and may now statistically, also, be equally as radically disproved. The data further above given from the small-pox hospital of this place, may fully set forth the fact that vaccinated cases present all the grave forms of small-pox in a similar manner as non-vaccinated cases. But, as on a statistical basis the numerical strength may afford decisive testimony, a table is therefore here reproduced which amply verifies the facts contained in our own statistics. The cases enumerated, with the exception of two (cases 30 and 32), were all vaccinated, and seven had been revaccinated, yet the “modified” forms are represented by the figures of lesser denomination.

(1) L. c., p. 38.

(2) Gutschall, l. c., p. 11.

(3) Ibid, p. 12.

Forms of Small-pox,	Cases.	Cured.	Deaths.
Malignant.....	5	..	5
Confluent.....	29	25	5
Discrete.....	42	41	1
Confl. modified.....	8	8	..
Discrete do.....	9	9	..
"Pustole numerabili".....	6	6	..
Febris specifica.....	4	3	1
Total.....	103	91	12 ¹

The total indifference, whether vaccinated or not vaccinated, as to the degree of severity of the disease, or in reference to final termination ending either in recovery or death, cannot be more convincingly exemplified than by the data of the following table, which are collected by Monteils² with the greatest care and pains of research:

Years of Age.	Vaccinated.	Unvaccinated.	Recovered.	Died.	Variola. Discrete, Conflu't	
0 to 10.....	8	124	100	32	67	65
10 to 20.....	48	78	122	4	74	52
20 to 30.....	31	63	78	16	36	58
30 to 40.....	33	33	59	7	38	28
40 to 50.....	14	27	38	3	19	22
50 to 60.....	4	13	20	2	15	7
60 to 70 and over .	9	2	7	..	4	3
Total.....	148	340	424	64	253	235

Here is brought to view that of 132 cases of the age from 0 to 10 years, but 8 were vaccinated, yet a more favorable result toward recovery is recorded by them than usually is the case in grave forms; here are three-fourths recovery, whereas, ordinarily, but two-thirds can thus be recorded. Also the table, in the column of mortality, indicates the same law—regarding percentage in comparison to age—as is observed in general mortality, and in small-pox cases that all were vaccinated.

The mere presumptive value of vaccination, claimed as the "protective influence" against small-pox, and its "modifying effect" during the first five years, and during any consecutive period of life, is well illustrated by the table which is here inserted, and is also copied from Oidtmann's pamphlet, already adverted to, and of which see p. 63:

(1) Cassone Giuseppe, l. c., p. 28.

(2) L. c., p. 102.

Small-Pox Statistics of the City of Elberfeld from 1860 to 1877.

Years of Age.	UNVACCINATED PERSONS.			VACCINATED PERSONS.		
	Taken Pox.	Died.	Percent.	Taken Pox.	Died.	Percent.
0 to ½.....	116	64	55.	16	17	82.
½ to 1.....	62	31	50.	21	14	66.6
0 to 1.....	178	95	54.	37	27	74.
1 to 2.....	61	29	48.	27	11	41.
0 to 2.....	239	124	51.4	64	38	59.3
2 to 3.....	32	11	34.	17	8	47.
0 to 3.....	271	135	49.9	81	46	56.8
3 to 4.....	39	15	38.	34	14	41.1
0 to 4.....	310	150	48.3	115	6	52.1
4 to 5.....	45	19	42.2	33	10	30.3
0 to 5.....	355	169	47.6	148	70	47.3
5 to 7.....	51	9	17.6	39	12	30.7
0 to 7.....	406	178	44.1	187	82	43.8
7 to 10.....	46	9	19.5	60	12	20.
0 to 10.....	452	187	43.3	247	94	38.
10 to 12.....	36	5	13.8	70	22	31.4
0 to 12.....	488	192	39.3	317	116	36.6
12 to 15.....	36	3	8.3	95	6	6.3
0 to 15.....	524	195	37.2	412	122	29.6
15 to 20.....	37	11	27.7	363	24	6.6
0 to 20.....	561	206	36.7	775	146	18.8
20 to 25.....	20	6	30.	615	40	6.5
0 to 25.....	581	212	36.4	1,390	186	13.3
25 to 30.....	13	4	30.7	446	54	12.1
0 to 30.....	594	216	36.3	1,836	240	13.
30 to 40.....	8	2	25.	544	96	16.1
0 to 40.....	602	218	36.3	2,380	336	14.1
40 to 50.....	4	1	25.	228	59	25.8
50 to 60.....	...	...	...	118	28	23.7
60 to X.....	1	1	100	47	16	34.
Total.....	607	220	36.4	2,773	439	15.8

It may be said that in a graphic representation the line indicating general mortality recedes from the extreme maximal numbers in the age from 0 to 1 to the extreme minima of the age, from 11 to 20, and from thence gradually to ascend to the age from 70 to 80. This law is universal, and in small-pox mortality it is found with the same precision reproduced.

The subject in view here is to elucidate the law that small-pox mortality, irrespective of vaccination, exhibits the same conformity with the universal law as is observed with mortality in general.

The tables adduced in verification of this law are copies of the data given by the official records of statistics of the Kingdom of Bavaria, and embrace a period of thirteen years—from 1857–58 to 1869–70. They are the more interesting as the Government of Bavaria is known to have enforced vaccination (since 1804) more rigorously than is done by the Prussian Government. Unvaccinated cases, therefore, are in Bavaria so exceptional, as nearly to rank among the impossibilities.

Small-Pox Mortality in Bavaria,¹ from 1857 to 1870.

Years of Age.	Total number.	Per 100,000 inhabitants living.	Per 1,000 Deaths of small-pox
0 to 1.....	1,704	111.9	356
2 to 5.....	258	4.7	54
6 to 10.....	56	0.9	12
11 to 20.....	67	0.6	14
21 to 30.....	259	2.4	54
31 to 40.....	450	5.4	94
41 to 50.....	551	7.4	115
51 to 60.....	750	12.5	157
61 to 70.....	583	13.7	122
71 and over.....	107	6.4	22

The table now following exhibits the general mortality—i. e., small-pox not included—in comparison to small-pox mortality of the Kingdom of Bavaria:

Years of Age.	General Mortality.	Small-Pox Mortality.	Difference.
0 to 1.....	443	409	= 34
2 to 5.....	28	17	= 11
6 to 10.....	7	5	= 2
11 to 20.....	3	8	+ 5
21 to 30.....	7	38	+ 31
31 to 40.....	9	56	+ 47
41 to 50.....	12	81	+ 69
51 to 60.....	20	106	+ 86
61 to 70.....	47	136	+ 89
71 to 80.....	118	103	= 15
81 and over.....	306	41	= 265

The data arrived at, applying to the City of Berlin for the year 1871, present quite similar numbers, and which are as follows:

Years of Age.	General Mortality.	Small-Pox Mortality.	Difference.
0 to 1.....	384	389	+ 41?
2 to 5.....	123	188	+ 65
6 to 10.....	12	41	+ 29
11 to 20.....	6	11	+ 5
21 to 30.....	10	31	+ 21
31 to 40.....	15	51	+ 31
41 to 50.....	21	77	+ 56
51 to 60.....	31	86	+ 55
61 to 70.....	56	86	+ 30
71 to 80.....	108	27	= 81
81 and over.....	270	9	= 261

Or to make it more conspicuously apparent that small-pox mortality, irrespectively of vaccination, follows the general law of mortality with reference to the age of the patient:²

(1) This and the five following tables except the third one are copied from Vogt's Pamphlet.

(2) Friedberg, l. c., pp. 29-30.

In Leipzig and its District,
per 100 deaths of small-pox.
1870-72.

In Berlin, 1871.

In Breslau, 1871.

Years of Age.	Deaths.	Years of Age.	Deaths.	Years of Age.	Deaths.
1.....	30.4	1.....	59.42	1.....	48.91
2.....	18.2	2.....	44.12	1- 2.....	38.51
3.....	13.9	3.....	37.75	2- 3.....	30.94
4.....	6.5	4.....	35.11	3- 4.....	29.53
5.....	3.6	5.....	36.80	4- 5.....	21.43
6.....	1.8	5-10.....	24.68	5-10.....	15.51
7.....	1.1	10-15.....	6.22	10-15.....	4.70
8.....	0.8	15-20.....	4.27	15-20.....	4.28
9.....	0.3	20-30.....	9.34	20-25.....	9.57
10.....	0.5	30-40.....	15.55	25-30.....	11.30
11.....	0.2	40-50.....	25.68	30-35.....	14.43
12.....	0.3	50-60.....	31.59		
13.....	0.3	60-70.....	35.74		
14.....	0.1	70-80.....	29.23		
15.....	0.0	80-90.....	25.00		
16.....	0.2				
17.....	0.1				
18.....	0.3				
19.....	0.0				
20.....	0.3				
20-30.....	2.6				
30-40.....	6.1				
40-50.....	6.4				
50-60.....	3.9				

The statistics of Berlin for the year 1871 contain parallel columns for the purpose of finding whether any deviation from the fundamental law governing the course of mortality is perceptible, and whether vaccinated cases have taken small-pox in contradistinction to unvaccinated cases. Here it must be noticed that the minima are found nearly alike in the years from 10 to 20; the other differences, however, accruing from these statistics in favor of vaccination, must more justly be attributed to the influences arising from the social and civil surroundings of the two classes of individuals. The unvaccinated, as a general rule, pertain either to the needy or indigent proletariat, or, on the contrary, to a class of clean people who enjoy but ill health and have a delicate constitution.

Small-Pox Statistics of Berlin, 1871, of Vaccinated Cases.

Years of age.	Small-pox cases.	Deaths of small-pox.	S. cases per 10,000 living.	S. deaths per 10,000 living.
0 to 1.....	179	99	88	49
1 to 2.....	298	127	158	68
2 to 3.....	295	111	164	62
3 to 4.....	244	78	150	48
4 to 5.....	175	69	115	45
5 to 10.....	651	150	91	21
10 to 15.....	556	35	89	6
15 to 20.....	1,600	67	200	8
20 to 30.....	4,336	386	214	19
30 to 40.....	2,990	448	216	32

Years of age.	Small-pox cases.	Deaths of small-pox.	S. cases per 10,000 living.	S. deaths per 10,000 living.
40 to 50.....	1,622	412	196	50
50 to 60.....	886	271	178	55
60 to 70.....	394	140	158	55
70 to 80.....	58	16	56	15
80 and over.....	3	1	18	6
Total.....	14,287	2,410	176	29

Small-Pox Statistics of Berlin, 1871, of Unvaccinated Cases.

Years of age.	Small-pox cases.	Deaths of Small-pox.	S. cases per 10,000 living.	S. deaths per 10,000 living.
0-1	723	437	357	216
1-2	502	226	267	120
2-3	338	128	188	71
3-4	223	86	137	53
4-5	151	51	100	34
5-10.....	224	66	32	9
10-15.....	38	2	6	0
15-20.....	84	5	11	1
20-30.....	203	8	10	2
30-40.....	127	37	9	3
40-50.....	60	20	7	2
50-60.....	32	19	6	4
60-70.....	20	8	8	3
70-80.....	7	3	7	2
80 and over	1	..	6	..
Total....	2733	1126	33.69	13.88

Contrary to the evidence and laws set forth by these tables, and being facts with which every observer must have had abundance of opportunity to become familiar every where and long prior to the present day, it is still asserted that vaccination exercises a "modifying"—i. e., mitigating effect on small-pox, and that on this account the mortality among vaccinated cases is by far less extensive. The comparative statements given by the Annual Report of the Board of Health of Philadelphia, 1872, pp. 10 and 79 of the Appendix, give the percentage as follows: The mortality of unvaccinated cases is 60.42 per cent., whereas of vaccinated cases is but 28.78 per cent.

Pissin¹ even represents the difference thus: Unvaccinated cases, 18.3 per cent.; vaccinated but 1.7 per cent. Observers, however, who state nothing but the truth, have recorded very different results. The source from which the following statistical data were obtained, must be considered as a most decisive and legitimate one, as there is a far greater homogeneity represented by the patients afflicted, in reference to their social relation, and as all were in official position, they were officially attended and

(1) L. C., p. 47.

under one system of supervision. The document embraces the officials of the Imperial State Railroad of Austria, numbering about 37,000, of whom, in the year 1873, a total of 2,054 had taken small-pox, ending with 1,669 recoveries, and 385 deaths. In reference to the "modifying influence" of vaccination the statistical data read thus:¹

Vaccinated.....	1,337,	of whom died	219	(16.38 per cent.)
Unvaccinated.....	596,	" "	148	(26.50 ")
Revaccinated.....	46,	" "	7	(15.20 ")
Having small-pox previously...	11,	" "	2	(18.18 ")
Doubtful.....	64,	" "	9	(14.25 ")

After the proof was furnished by overwhelming numbers that vaccinated persons took small-pox in the same ratio as unvaccinated ones, the assertion was then assiduously repeated that revaccination would surely protect,² or when actual small-pox had been taken certainly such person would be invulnerable for ever. To prove these assertions as entirely illusive, statistical data may therefore be here reproduced by which the contrary is recorded. From the epidemic visiting the city of Breslau in 1871, the following data are obtained:

Unvaccinated.		Vaccinated.		Revaccinated.		Having had s.-p.	
Light.	Grave.	Light.	Grave.	Light.	Grave.	Light.	Grave.
67.31 per ct.	32.68 p. c.	81.00 p. c.	18.99 p. c.	74.59 p. c.	25.40 p. c.	57.94 p. c.	42.05 p. c.

The total number of cases having been 6,704, of which 5,523 were vaccinated, and 1,181 unvaccinated cases.

Among the cases admitted to the hospital at Breslau in 1871 and 1872—the total number being 2,416—are 102 cases recorded that had small-pox previously. Also with the same author is found a list of cases that have had small-pox several times, namely: 3 cases that had small-pox twice;³ 3 cases, several times; 2 cases, 3 times; 1 case, 5 times; and 1 case, 7 times. (The last named case died when 118 years old.)⁴

Other statistical data record of 1678 cases of variola and varioloid, 57 that had small-pox previously, making a percentage of 1 in 39.4.⁵

(1) Gottschall, l. c., p. 13.

(2) Pluskal, l. c., p. S.; and Pissin, l. c., pp. 35 and 46.

(3) An additional case is stated—first having varioloid, then being successfully vaccinated, and five months later upon the second vaccination semi-confluent small-pox followed. Nierker, l. c., p. 56.

(4) Friedberg, l. c., pp. 67, 81, 82.

(5) Controverse ueber die Impffrage, p. 11.

From personal observation notes are preserved recording 3 cases that were previously successfully vaccinated and having small-pox twice consecutively.

The mortality of variolated, revaccinated, and vaccinated cases was at Breslau as follows:¹ 1st class, 12.75 per ct.; 2d class, 10.48 per ct.; 3d class, 12.67 per ct.

Through the advancement of science and more carefully collected statistical data the imaginary merit of vaccination has thus been effectively disproved, but as there is yet, notwithstanding, an overwhelming majority who can or will not accede to the most commanding and elementary facts in nature, the advocates of vaccination, they have ultimately retreated and concealed themselves behind the phrase, that of late the number of unvaccinated cases was becoming greatly augmented, and owing to this circumstance small-pox had an opportunity to spread, but there, where compulsory vaccination laws were in force, small-pox were to be considered literally stamped out.

Quite the contrary is the true nature of things, proved by the facts emanating from recorded history. In the first place the number of unvaccinated persons is at present 5 to 6 times less extensive than fifty years ago; but, secondly, the rate of occurrence of small-pox is 26 times more extensive. These facts may be learned from the following table:²

Period.	No. unvaccinated	Small-pox mortality per 100,000 inhabit'rs.
1820	68,000	10
1831	48,000	12
1841	33,000	14
1850	23,000	16
1860	15,000	19
1871	12,000	243
1872 .....	.....	260

After the entire failure of vaccination as a preventive or modifying (mitigating) means over small-pox has been demonstrated to the world for an entire century, the dogmatists of vaccination have sought relief periodically in their agony of perplexity, in the assertion that the negative results were owing to degenerated or defectively cultivated lymph, and it is thus claimed that its antagonistic and specific nature is not found in it. Sometimes to the fresh bovine lymph the appeal is directed, but after a general dissatisfaction can no longer be prevented, then rescue is sought in the "humanized" lymph, and so on alternately.

(1) Friedberg, l. c., p. 83.

(2) Oidtmann, Impfigegner, p. 90. These statistics are taken from the Prussian records.

Upon minute and accurate investigation, however, both kinds of lymph are found identical, and even more, they are found identical with that of the genuine variola pustule. Any perceptible difference is more an incidental predominance of pus cells, and that upon evaporation vaccine lymph presents dendritical formations, which indicate a high percentage of inorganic salts, and, according to the crystalline form, they remind the observer of the crystals of urate of soda, and a urate of ammonia.¹ Under the head of morbid anatomy, the histo-chemical and anatomical data of the lymph of the "distinct variola pustule" has further above already been indicated, of which the isolated facts of observation precisely correspond with those obtained from investigation of the vaccine lymph.

The treatise on this subject, submitted by Keber, is most minute and exhaustive; and the facts arrived at and thereby set forth corroborate those obtained from our own investigation: the principal data pointed out by Keber may therefore be specially alluded to.

"Under the impression that the contagion of small-pox, as an organic entity, was to be found in the blood, or in the contents of the pustule of the patients, observers have hitherto directed their attention to these fluids, but their efforts have not led to any conclusive results. The same is true with reference to vaccine lymph. It is microscopically considered, even to the present day, looked upon as free from specific organic admixture."—"In the clear lymph of the pock there are always found thread-like coagula, and if 'vaccination' is performed with them they produce genuine vaccinal pustules. A perfectly clear lymph of the pock is never observed, always some coagula are to be seen, which is the same in vaccinal lymph, and containing besides the coagula, pus corpuscles and granulated cells."—"The thread-like coagula were, under the microscope, discerned as a conglomerate of granulated cells, granules and innumerable molecules, which are highly qualified for the propagation of pocks."—"In dried lymph, carefully softened in distilled water, the same observations are made."—"The dendritic forms of crystals, produced on evaporation of the lymph, are indications of a high percentage of salts, of which the chemical constitution has not yet been ascertained, but may be suspected as urate of soda and urate of ammonia."—"The serum or lymph of variolæ, varioloids and varicellæ presents no

(1) Keber, Mikroskopische Bestandtheile der Pocken-Lympe, Virchow's Archiv B. 42 p. 112, et seq.

characteristical difference, from all of them it contains pus corpuscles, granules and molecules.”—“Pathologists who incline more to take the chemical view of the morbid process of small-pox, may be possessed with the above indicated data with cogent reason to assert that those coagula, etc., are the products of regressive action, ending in the formation of pus, as is the case in other ulcerating processes.”

Repeated microscopic investigation, to which we have resorted have not revealed any other facts than we have given in reference to the lymph of the small-pox pustule, and those obtained by so high authority and competent inquiry as Dr. Keber, in regard to the lymph of the vaccine pustule. As long as the vaccinal lymph is quite clear and transparent, the granulated corpuscles are frequently less numerous, but granular white (lymph?) cells are always seen in great numbers, which have by some been designated “spherical baterii,” all of which, however, in the consecutive progress of development, or decay, become granular and form into pustules. The causal difference in the origin of the vaccine pustule, is the local introduction of regressive (decayed) animal matter into a *healthy* organism, and thus its effects remain, in the great majority of instances, but local septical (gangrenous) abscesses of limited dimensions, which, to the good fortune of the “vaccinated,” are cast off again. As no utter difference, synthetically and analytically, can be made out in contra distinction of vaccine lymph and variola lymph, which fact is acknowledged by Coze et Feltz,¹ after extensive, minute and careful observations, by proclaiming: “Le virus variolique se comporte absolument comme celui de l’humeur vaccinale;” yet enlightened (?) nations inflict fine and imprisonment for the “offense” of practicing “inoculation,” as also for the “offense” of OMITTING VACCINATION.²

Great numbers of observers, with strenuous efforts, have endeavored to indicate, from the results of experiment and direct analytical research, specific characteristics of the various kind of pustular lymph, but so far, in every single instance, negative results may be recorded, with the exception of one, viz: the *deleterious effects* of either kind upon a healthy organism.

When experience had inculcated the fact that “homogenic” (humanized) lymph proved to be devoid of protective power

(1) L. c., p. 170.

(2) Vaccine virus or lymph is apt to be contaminated in the human organism by syphilis or syphilitic dyscrasy, and in the bovine species by that of the “cattle plague,” either by that of the lungs or by that of the hoofs (Lungen- or Klauenseuche).

against variola, salvation it was then argued was to be found in the "heterogenic" lymph; but the bovine lymph also failed in the desired, object and then "ovine" was employed, but, alas! with the same results as the other.¹

Experiments were instituted for ascertaining whether an identity in the action of producing "vaccine pustules" could be traced with the various kinds of lymph, and naturally the effects were alike, whether horse-pox, cow-pox, human-pox, sheep-pox, dog-pox or even hog-pox were employed, when with these specimens of decayed or septical animal matter "vaccination" was performed "vaccine"—i. e., gangrenous pustules—arose upon the surface, and in which no difference or distinction could be discovered.²

In accordance with the theory of specific infection and the parasitistic doctrine, advanced by Hallier, it is stated that vaccine lymph is full of parasitical growths—micrococcus—(which, however, is only found in an advanced state of putrefaction) which rapidly multiply and infect the blood of a vaccinated child entirely after a couple of days. Is the same child in course of a week then "infected with small-pox poison," also said to be a species of parasitic growth, supposed also to enter the blood and multiply. Both species of parasitical growths would enter into a combat, and the final victory would certainly be on that side where the numerical strength prevailed; in the case here supposed, the victory must be with the vaccine, as they were a full week's time in advance.³

Could the laws of nature and man's reasoning faculties be exposed to a grosser satire than to such enormous absurdity? And for such meritorious (?) production the Russian Government has seen fit to award one-half of the prize of 3,000 roubles in competition for the best treatise on vaccination, and thus forcing it into medical literature. By the experiments of those who are largely engaged in the practice of vaccination, the facts have been discovered that clear (transparent) lymph takes better than opaque or such that is entirely putrid. In clear lymph, as we know, besides the ordinary albuminous coagula (fibrinous shreds,) numbers of transparent white cells, are found, which are

(1) Pissin, the great vaccine-lymph cultivator and dealer, had even to acknowledge this. See l. c., p. 81.

(2) Comp. Monteils, l. c., pp. 133-194; Chairau, *La Variole et la Vaccine*, pp. 54-59; Oidtmann, *Zwangs-Impfung*, pp. 116-125; also Curschmann, *Ziensen Cyclopadia*, etc. p. 402; and Pluskall, l. c., p. 38, et seq.

(3) Pissin, l. c., p. 157.

histologically termed protoplasmatic spheroids, and as found in the lymph of pox or vaccine, they are of morbid origin, and appertain to the regressive metamorphosis; their natural and ultimate issue is formation of pus and ulterior decomposition.¹

The development of these bodies arises from stagnation and decomposition of the blood, as is demonstrated by Cohnheim,² and their final termination into pus. Hering and Cohnheim³ have further indicated that those white cells are absorbed by the lymph vessels, and thus enter the general circulation, but as Samuel⁴ has shown, when from infiltration the parenchyma excludes the arterial and venous circulation, true gangrene must result. And further, it is demonstrated by experimentation, if those substances of decay or of regressive tendencies enter the circulation "That they cause multiple coagula and thrombosis by dissolving the cellular elements of the blood, and thus setting free fermentating substances and increasing the formation of fibrinoplastic thrombi and coagula."⁵

Now *verbatim et literatim* the data, brought to view by vaccination, are found to correspond with the facts demonstrated by experimentation arising from the inoculation of the vaccine lymph (immaterial of what species), the white cells (regressive protoplasmatic spheroids) and portions of albuminous coagula are absorbed by the lymphatics, producing decomposition of the lymph contained in the vessels, and thus swell the parenchyma. Portions of the decomposed lymph that may then have already been absorbed and circulated through the general system, predisposing to the formation of peripheral thrombi (pursuant to the law that alkaline decay seeks the surfaces to which atmospheric air is accessible), and as under the influences exercised they are but on a minimal scale, the selection for localization follows the old pathological maxim: "ubi irritatio ibi affluxus." and to the point of vaccination the morbidly altered blood will primarily flow, thus augmenting venous stasis. Diapedesis, which now conspicuously follows, produced partially by the process of decomposition of the blood already taking place, and partially by the pressure exerted upon the volume (lumen) of the vessels from the swelled parenchyma, developes the local phenomena of inflammation and thrombosis, leading to gangrene upon the exclusion of the circulation of arterial blood.

(1) Comp. Cohnheim, Embal. Proc., p. 102.

(2) Entzündung, pp. 66 and 67.

(3) Embol. Proc., p. 37.

(4) L. c., p. 66.

(5) Koehler, l. c., p. 111.

Owing to the amount of septical substance which is consecutively absorbed by the lymphatics, and to the degree of inability—*locus minoris resistentiæ*—of the constitution to react against the septical poisoning of the blood, the degree of fever and general disturbance, following vaccination, is dependent. The degree of local lesion of the circulation and tissue destruction, probably determines the nature of the local inflammation, whether the vaccine will take the ordinary course, or whether the inflammation assumes an erysipelatous character, or whether it may be followed by large sloughing and sphacelating ulcers and necrosis of the bone beneath.¹

To the extent that visible injurious effects follow vaccination in the cuticle, ill consequences must take place in the lungs, owing to the relation of vicarious actions of both organs, their exterior surfaces being in direct contact with the atmospheric air, their parenchyma being thus liable to be infiltrated by septical material and the blood vessels to the formation of emboli (as far as the caliber of the vessels favor it, for the volume of the pulmonary capillaries is larger—wider—than others).

If any septical substance (pus or but serum) finds access (is injected) to the arterial circulation, innumerable miliary spots are consecutively found in the lungs, and Panum has observed that from such capillary emboli nodules arise which entirely resemble tubercular infiltration.²

The experiments instituted by Cohnheim and Fraenkel have set forth the fact that tuberculosis is produced by inoculating, not alone decomposed pus, but any other irritating substance, in consequence of which a chronic ulceration with necrobiotic decomposition takes place. In particular, the experiments made by Ruge prove that in consequence of a chronic inflammation tuberculosis may be produced, which is developed by bringing into the abdominal cavity of the Guinea pig even pieces of cork.³ The imminent

¹ (1) Comp. Cless, l. c., p. 90.

(2) Koehler, l. c., pp. 47-56.

(3) Virch. Cell. Pathol., 4th Edit., pp. 261 and 545; also comp. Both, on small-pox and vaccination, 2d Edit., pp. 58 and 59. Further—Consumption—p. 111. If yet, in an air of hebitude and carefully nurtured "*a son aise*," it may be thought safe to announce that, "How it could be inferred that the origin of tuberculosis could be traced to vaccination, is not clear to my mind." Condolence and sympathy could possibly be entertained were it not for the melancholy nature of this testimony that biological and physiological knowledge cannot reach a counsellor of health. Comp. Wilhelm, l. c., p. 32.

Friedberg, in his official capacity, and probably from motives of dotated interest, could also not see that tuberculosis would arise from vaccination, but could avoid acknowledging that, "Indications of this disease were more prominent after vaccination than prior to it, and that proper precaution required that scrofulous and tuberculous individuals should be vaccinated only when a variola epidemic was threatening."—Comp. l. c., p. 92.

danger of permanently injuring health, and of bringing life into early peril, arising from vaccination, must thus be fully apparent; if yet its practice is insisted on it cannot be considered anything else than *a wilful crime, and should certainly be liable to the same penalties as all other criminal practices against life.*

So far as general statistical data bear evidence of the relative frequency or extent of vaccination and revaccination, coinciding with the increased rate of percentage of the mortality of pulmonary tuberculosis, most instructive evidence, forcing itself to be biologically recognized, is thus presented to the observer, which gives irrefutable expression of the natural consequences arising from vaccination that are above indicated. The following tables and data may contribute to make those truths more apparent:

	Year.	Pulmon'y Tuberculosis p. 100,000 inhab. ann'y.		Mean p. 1,000 deaths.
City of Geneva.....	1838-55	.....	240	117
England ¹	1848-54	.....	290	126
“.....	1850-59	.....	270	122.3
“.....	1858	.....	261	113.6
“.....	1859	.....	257	113.8
“.....	1838-41	.....	300	172
London.....	1848-54	.....	290	115
“.....	1856	.....	295	127
“.....	1858	.....	273	115
“.....	1859	.....	280	125
Belgium.....	1856-59	.....	370	164
“.....	1851-55	.....	340	152
Limburg.....	1856-59	.....	490	214
East Flanders.....	1856-59	.....	460	196
Namur.....	1856-59	.....	250	135
Luxemburg.....	1856-59	.....	250	129
Paris.....	1838-51	.....	410	131
“.....	1853	.....	452	134

The increase of mortality, and especially that of tuberculosis, after the more rigid execution of “virusation” (vaccination) is well exhibited by the following statements:

“According to Dr. Pearce,² there died in England in every 12 years, from 1838 to 1842, and from 1847 to 1853, 4,586,654 persons; from 1854 to 1865, 5,319,071. Of the special disease, consumption, there died in every 12 years, from 1838 to 1842, and from 1847 to 1853, 1,027,862; from 1854 to 1865, 1,257,438.”

The mortality of infant children under one year of age is also on an exact ratio to the rate of vaccination.³

(1) In the year 1854 the compulsory vaccination enactments were enforced. Table is copied from Oerterlen, Handbuch der Med. Statistik, p. 375.

(2) See Controverse ueber die Impffrage, p. 57.

(3) Controverse ueber die Impffrage, p. 58.

Year.	Per cent. of vaccina'n to births.	Mortality from all causes of children under 1 year of age.
1853 ¹	33	318,000
1854	65	408,000
1855	56	354,000
1856	54	350,000
1857	52	338,000
1858 .....	.. .....	341,000
1859 .....	.. .....	335,000
1860 .....	.. .....	354,000

By the table here now reproduced will be found indicated the differences of percentage of the mortality from pulmonary tuberculosis in those cities and states where vaccination is less rigidly practiced, in contradiction to those where its practice is strictly enforced.

The first series registers those localities of the first description:²

Localities.	per 1000 inhab.	per 1000 deaths.	Localities.	per 1000 inhab.	per 1000 deaths.
Algiers—1852-59.....	2.8	70.1	Naples.....	—	80
Brunswick (city)—1843.....	2.9	....	Rome.....	—	60
France, in cities—1845.....	2.7	100	St. Helena—1834-40.....	2.2	—
Genoa—1858.....	3.0	97	Turin—1857.....	2.6	93
Ireland—1840-45.....	—	130	Venice.....	—	88

Localities of the second series, or where vaccination and revaccination is strictly enforced and diligently practiced:

Localities.	per 1000 inhab.	per 1000 deaths.	Localities.	per 1000 inhab.	per 1000 deaths.
Aberdeen (Scott'd)—1860...3.4	127	—	Manchester—1838-40.....	4.8	—
Bavaria—1844-50.....3.7	130	—	Massachusetts—1841-40.....	2.9	222
Baltimore—1836-51.....4.0	—	—	Munich—1845.....	3.2	129
" 1810-20.....	150	—	New Orleans—1844—	—	—
Berlin—1850-55.....3.8	145	—	{ White.....	6.4	—
" 1830-44.....	175	—	{ Colored.....	4.1	—
Birmingham—1838-40.....4.8	—	—	New York—1840-50.....	4.0	146
Boston—1811-40.....4.0	280	—	" 1805-37.....	5.3	200
Edinburgh—1860.....2.9	120	—	Philadelphia—1807-40.....	5.0	—
" 1840-48.....4.8	110	—	Stuttgart—1828-37.....	—	212
Glasgow—1860.....4.3	130	—	" Hospital—1857... ..	—	260
" 1846-48.....7.0	170	—	Vienna.....	—	200
Liverpool—1838-40.....6.4	—	—	" Gen. Hosp.—1850-58. —	—	300

With reference to the high rates of mortality from pulmonary tuberculosis, coinciding with an increase of revaccination, some statistical data of those cities where revaccination is practiced to an excess may here be subjoined, and the direct bearings are prominently exemplified by the exceedingly high percentage recorded for Vienna. In this place, it is stated: "By the prevalence of a light epidemic of small-pox (in 1870?) the entire population was taken with such terror, that revaccination was practiced to an extent as was never seen before on any occasion."

(1) Introduction of compulsory vaccination.

(2) Both tables are copied from Oesterlen, Handbuch, etc., pp. 375-6.

Localities.	Year.	Death rate of pulmon. tuber- culosis of total mortality.
Vienna ¹	1871	25.33
Geneva.....	.....	23.3
New York ²	1871	15.5 ²
London ³	1859	13.90
Philadelphia.....	1871	12.3 ²
St. Louis ⁴	1872	11.37
New Orleans ⁵	1873	11.3 ²
Richmond, Va., ⁷	1872	14.44
Baltimore ⁸	1872	10.80
Cincinnati ⁹	1871-2	11.11
Berlin ¹⁰	1861-72.....	16.7 <small>mean fluct'n, 14-18.</small>

Probably adequate and conclusive scientific and statistical evidence may have been produced by which the claimed merits of vaccination is fully invalidated, but to anticipate the rejoinder, if its benefits thus appear to be disproved, yet the continuance of its use has not yet been directly proved detrimental, an attempt has been made to tabulate here a statistical review of recorded data of direct injuries, and thus to submit the final proof that shall *disqualify vaccination to rank among those hygienic measures designated prophylactics.*

Prominent indications, arising from the evidence developed under personal observation, suggested that vaccination, as a general law, would be followed by injurious effects and fatal consequences, and that a column should be devoted, in the table of vaccinal statistics, recording all the direct injuries thus produced. Also, justifying the insertion of the data from personal records as first in order, for they may contribute to demonstrate the importance that such observations should fully be recorded and the records candidly published; the particular point of interest lies in the circumstance, that these data were obtained during two epidemics in private practice, and in a case in which professional practice was not very extensive; and as even in this case an alarmingly great percentage of injury from vaccination was

(1) Jahresbericht, etc., pp. 73, 157, and Table iv. p. xxv.

(2) Ann. Rep.

(3) Oesterlen, l. c., p. 757.

(4) Ann. Rep.

(5) Ann. Rep.

(6) Ann. Rep.

(7) Ann. Rep. The population of this city is estimated to be 60,000; the number vacce. and revaccinated in 1872 was 13,031.

(8) Ann. Rep. This percentage are the quota of ten months, from Jan. to Oct. inclusive. The population of this city, 267,354; the total number of vaccinations of the full year—from Nov'r 1st, 1871, to Oct'r 31, 1872—was 38,305, of which 10,005 were primary and 28,240 revaccination.

(9) Ann. Rep.

(10) Virchow, Sterblichkeitsverhältnisse Berlin's, p. 19.

brought to notice, it is evident that an extensive list of serious cases of this kind present themselves to the observation of every physician, and especially so to those largely engaged in the performance of vaccination and in charge of institutions and hospitals. But if such evidences are purposely withheld from public notice, necessarily involves an offence of a criminal character against the welfare of man.

The data, noting direct injury from vaccination are the following, from our personal observation:

2 deaths, from absorption of septic substance, resulting in decomposition of the blood.

2 individuals, each losing an eye from inflammation, that resulted in an abscess upon the cornea.

4 persons taking erysipelatous inflammation of the arm vaccinated, extending to shoulder and elbow joints.

In 6 cases the points of vaccination resulted in large sloughing ulcers, and in two with partial necrosis of the bone.

2 cases, previous to vaccination perfectly healthy, exhibited permanent glandular enlargements.

In addition to these data, other statistical facts as found, although but scantily, in the literature, enumerated at the beginning of this essay, and may now here be adverted to. to which, however, two deaths must be added, that were reported by the daily press from Massachusetts in 1874, and could not be attributed to any other cause than to vaccination, which was performed shortly previous to the deaths of victims.

With candor, Cless¹ states that the official records of Wuerttemberg, for a period of fourteen years, give account of 579,675 vaccinations, and of that number 308 fatal cases occurred. Also that in addition to these numbers 4 deaths were recorded having resulted from erysipelatous inflammation produced by vaccination, and the 5th case, ending fatally, designated "an apparant lethal termination of a case of vaccination," of which the diagnosis was given "endomyocarditis, with formations of thrombi." Owing, however, to the official capacity—"Chief Sanitary Counsellor" of the City of Stuttgart, an office filled by the Government—of this author, the causes of death of those 308 fatal cases of vaccination, are endeavored to be ascribed to those common in infantile mortality.

(1) L. c. pp. 10 and 11.

In the year 1801 the schoolmaster in Bothnang, Wuerttemberg, lost one of his children in consequence of vaccination, but for the sake of conformity to the popular prejudice, *the death was attributed to an "insignificant catarrhal fever."*¹

Three more deaths from vaccination are reported from Sheffield, England. The victims were children, who after vaccination had become afflicted with erysipelas, resulting in fatal termination.²

The last case of this list occurred in Greeley, Colorado. The person sacrificed was a female of the age of three years, perfectly healthy prior to vaccination. This operation had been performed March 16, 1877, from a quill of bovine virus, coming from a reliable vaccine producer, who is endorsed by the health officers of St. Louis and Cincinnati. On the twenty-first day after vaccination, when the arm was greatly swollen and *slightly reddened*, the ensuing death of the patient was announced by the attending physician as the result of septicæmia.³

Upon further examination of the records of vaccination, the fact emanating from the records of personal observation, viz: vaccination being frequently followed by erysipelatous inflammation, is found fully corroborated already by the data mentioned of some of the cases terminating fatally. Jenner already observed phlegmonoid erysipelas to follow vaccination, and has frequently been indicated by him,⁴ and in the Foundling Hospital at Petersburg, of 5,000 vaccinated infants, 57 took erysipelas in consequence of vaccination and died.⁵ Also in Boston erysipelas has been seen to follow upon vaccination; that at various occasions vaccination had to be suspended.⁶

Nay, the fact forced itself upon the recognition of those who, from official inspiration, could not see anything else arising from vaccination but "an immense good," yet 3 cases of erysipelas caused by vaccination, and occurring in succession, were noticed by Wilhelmi,⁷ and quite recently at Stockton, Eng., a child was attacked by erysipelas in consequence of vaccination, and died.

Friedberg⁸ attempts to specify an additional class or kind of erysipelas, designated "infectious erysipelas of wounds" (*Wund-*

(1) Cless, l. c., p. 105.

(2) London Lancet, Dec. 22, 1870, p. 740.

(3) Clinical Record, St. Louis, Mo., Jan. 1878, p. 258.

(4) Bedoin, l. c., p. 3.

(5) Nierker, l. c., p. 33.

(6) Nierker, l. c., p. 34.

(7) l. c., p. 32.

(8) Lancet, Nov. 17, 1877, p. 740.

(9) l. c., p. 93.

vergiftungsrose), which he admits to occur frequently after vaccination, and often proving fatal.

Other complications, allied to erysipelas, are frequently observed to follow vaccination, from which untoward consequences are not uncommon. The chief species are the following: Ecthyma, impetigo,¹ eczema² (frequently spreading all over the arm from shoulder to wrist, and requiring three months for a cure) and rubeola.³

Moreover, above, in the anatomical and histo-chemical description of lymph from vaccine and small-pox pustules, the identity of both species has been proved, and thus the mindful observer can not disregard the danger imminent to vaccination. The mournful fact that destructive inflammation may befall one or the other eye of those vaccinated, which is demonstrated by the list of "direct injuries," as met with in personal observation, finds a more impressive bearing from another fact, which will fall to the observation of every practitioner, namely, that small-pox patients frequently suffer from a variolous abscess of the cornea, ending, invariably, in opacity and staphyloma, or in entire destruction of the eye. The records from the Eye Infirmary at Leipzig submit fair indications with reference to the frequency of ophthalmic complications will ensue. During one year (1872?), when an epidemic of small-pox prevailed, 58 "grave cases" were there admitted,⁴ said to be the greatest percentage of ophthalmia from small-pox there observed for fifty-one years.

Inflammation and hypertrophy of lymphatic glands, as a sequel to vaccination, has also been observed by others, so also large and sloughing ulcers,⁵ which many observers have supposed to be owing to a syphilitic stain of the vaccine matter employed, though from personal observation this assumption is not sustained. In several families single cases of these untoward consequences were noticed, while others, vaccinated with the same lymph, were not molested.

One more additional point remains for consideration, in connection with the subject of vaccination, which is: Can syphilis be and is it imparted with vaccination? The answer to the interrogation has been given once already in the affirmative, under

(1) Bedoin, l. c., pp. 5-9.

(2) Cless, l. c. p. 52.

(3) Friedberg, l. c., p. 93.

(4) Wilhelmi, l. c., p. 38.

(5) Comp. Friedberg, l. c., p. 74; Cless, l. c., p. 10; Nierker, l. c., p. 67; Bedoin, l. c., pp. 4-15; Monteile, l. c., p. 324; Pissin, l. c., p. 133.

the impression of the specificalness of disease in general, but of that of small-pox and syphilis in particular. But the adherents and admirers of the magic power of authoritative rulings, from motives best known to themselves, never met in their own practice nor in other statistical data with evidence in proof of syphilis thus being conveyed. Cless,¹ in the first instance, states: in Wuerttemberg not a single case—even of a suspicious nature—has been brought to official notice as long as vaccination has been practiced there (since 1818 vaccination laws have been in force), and Wilhelm² has never yet seen a case of this description, and strenuously denies even the possibility, because, according to him, in vaccine lymph no syphilitic matter is contained, as in it nothing could be found which is allied to blood, and syphilis could only be conveyed by means of blood.

So far from natural history the facts are derived, warranting the inference that there is nothing “specific” in the morphological processes upon the earth’s surface, leading either to progressive or regressive development. Syphilis, consequently, can not be looked upon as exceptional to this law, and if the mode of its propagation and its natural deportment is investigated with unbiassed attention, there will be found singular similarities with other cachetic products, resting upon structural alteration of the glandular system and its consequent morbid secretions. Primarily such are the cancerous and the tuberculous cachexies, glanders, anthrax, and lyssa; secondly, the viper poison, etc.³ Syphilis appears thus simply a “variety” of morbid products, which, when absorbed by the human organization, reacts also as a “fibrinous fermenting substance” on the protoplasm of the organism, and, owing to its morbid constitution, the products following have glided upon the plain of regressive action into a circuit of more energetic destruction, analogous to the vaccine and small-pox virus.

“Humanized” vaccine virus never precludes the possibility—nay, probability—of a syphilitic contamination, and bovine vaccine

(1) L. c., p. 10.

(2) L. c., pp. 34-38. The acknowledgements of this writer are actually surprising. His pamphlet is published in 1873; whereas, if the observations of Cohnheim, already published in 1st Vol. of Virch. Arch., 1867, had been familiar to him, demonstrating where the material is derived from forming the product of inflammatory action, such avowals of more than doubtful propriety, would certainly have been spared him; also the *dementia* to the Government of his State (Prussia) where, as is said, only knowledge and competency elevates to office.

(3) Certainly it is not to be understood that these specified substances should directly be injected into the blood; nay, the meaning is to apply them to the mucus surfaces, or for absorption generally, analogous as syphilis is acquired.

virus that of the cattle plague (Lungen-und Klauenseuche) and the glanders (*Biscula* or *Ruminantia*, are liable to the glanders, which is well exemplified in sheep.)

When now *Wilhelmi*,¹ in his royal official capacity, unhesitatingly asserts, "The danger of conveying constitutional diseases by means of vaccination does not exist if only lymph free from (admixtures of) blood is inoculated," it would appear eminently proper to direct his own sarcasm (?) against himself: "Man merkt die Absicht und man wird verstimmt." (The purpose is perceived, giving rise to ill-temper.)

Immaterial, however, to the view entertained of the nature of syphilis, so much is evident that the vaccine virus taken from a person who previously has suffered from syphilis, reacts greatly more injuriously upon the system of others, free from syphilis, than the virus taken from a "healthy" person. A number of casuistical records afford ample proof in support of this fact, and some of them may therefore here be reproduced. One of the most striking examples is that reported by *Dr. Lecoeq*, in *Cherbourg*,² stating that a recruit, who, prior to his enlistment, has had an "infecting" chancre, which had healed, without any attention being given to it, and leaving the recruit in supposed perfect and good health; the belief in his sound health was entertained by the medical attendant who revaccinated him. From him (the recruit) lymph was taken for vaccinating others, but after a due interval symptoms of secondary syphilis were manifested by all those thus vaccinated.

*Nierker*³ reproduces from the Berlin Clinical "Wochenschrift" of February 21, 1870, the following: On the 19th of January of the same year, the official vaccinating physician vaccinated 18 children with lymph that was taken shortly previous from source unknown. Upon the rumor that syphilis was conveyed to these children, "Geh. Medicinalrath," *Dr. Mueller* of Berlin, examined them, and found seven, on the 27th of January, with whitish, round and flat ulcers around the anus; the points vaccinated exhibited nothing abnormal, only feebly developed vaccine pustules. On the 28th of January additional seven of these children were examined, with the following result: One with ulcers on the lower lip and swellings of the sub-maxillary glands; another with erysipelatous inflammation of the upper arm; the third one

(1) *L. C.*, p. 51—Conclusions, propositions, 4—and p. 37.

(2) Recopied from *Pissin*, *l. c.*, p. 137.

(3) *L. C.*, p. 67.

with an eczema in the vicinity of the vaccine pustules; all had feebly developed vaccine pustules.

Rahn¹ reports the history of 11 cases, from his own observation, in whom syphilis was transmitted beyond all possible doubt, and referring to the publications of Prof. Kussmaul, 25 additional cases are there found reported, copied from the monograph of Dr. Heyd, who, with certainty and accuracy, had diagnosed and described those cases.

Not in every instance are syphilitical affections observed to follow vaccination, although lymph is taken from sources that are syphilitically contaminated. This appears evident from the observation made by Koebner and stated by Friedberg:²

Of 21 persons, who were vaccinated with syphilitic blood, but six had taken syphilis: of 324 individuals vaccinated with lymph taken from a syphilitic subject, but 222 had taken syphilis, 61 remaining unaffected (healthy.)

From the mass of evidence upon the transmissibility of syphilis with vaccination,³ of which but a part is reviewed by this author (Friedberg), the conclusion has matured that by means of "humanized" vaccine lymph syphilis is conveyed, and that there is a "*syphilis vaccinata*."⁴ The authenticated records, stating the results or personal observations of authority of high repute, is rather too extensive to be reproduced here, and may best be perused in the referendary's treatise. Here are merely given the total figures, which are the following:

Vaccinations with lymph from Syphilitic sources in children.	Manifesting marks of syphilis after vaccina- tion in children.
Total 394	Total 236
In youth.	In youth.
Total..... 11	Total..... 9
In grown persons.	In grown persons.
Total..... 26	Total..... 19
Grand total..... 431	Grand total..... 264

Monteils,⁵ prepossessed in favor of vaccination, was consequently not disposed to see anything injurious arising from vaccination, but to believe the syphilitic stains, sometimes noticed with the vaccine pustules or syphilitic affections of the system

(1) L. C., p. 39.

(2) L. C. p. 97.

(3) There being more than 500 publications upon this subject. See Pissin, l. c., p. 135.

(4) Friedberg, l. c., p. 94 et seq.

(5) L. C., p. —.

following vaccination, were more properly to be ascribed to other influences than vaccination. However, this author could not avoid to mention, on the pages from 361 to 376 of his work the number of 167 cases in which, beyond all doubt, syphilis was transmitted with the vaccine lymph.¹ It is a mark of civility to extend indulgence toward custom, but with reference to vaccination, as it is now proved to be not only worthless but pregnant with great danger, this indulgence is wholly inadmissible, and if its practice is still insisted on—nay, enforced by legislative compulsion—so much more is the offence a criminal one thus committed against the health and life of man.

At various epochs in general history many facts most prominently testify that practices established by legal enactments were in subsequent periods proscribed as offences and subjected to capital punishment (c. g., the burning of the witches; inquisition; "inoculation," etc.)

In conformity with the facts demonstrated by the advancement of science and sustained by statistical evidence, no other course of legislative action would be so much in harmony with the progress of history as the passage of a law reversing the enactments in favor of compulsory vaccination and declaring this practice to be what its nature implies, a criminal offence.

There is not a shadow of scientific reason upon which the justification of vaccination could be based; quite to the contrary, it has been proved to be but a septic poisoning: an assault against health and life. Yet, nations, by whom the very height of scientific attainments are represented, allow the imposition of crude and arbitrary police regulations to establish compulsory vaccination, fastened upon them by a merciless and selfish speculation, aided by those representatives (?) whose valuable services may, perhaps, at any time be secured for "thirty shekels."

The most formidable and injurious to their own nations are the compulsory laws of England, Germany, Sweden and Norway, and Denmark.

In England the law is in force that if any one—parent or guardian—fails to have his child, between the age of 3 months and 14 years, vaccinated, a justice of the peace may inflict a fine of 20 shillings and one month imprisonment upon the parties named, and to repeat the same as often as may be requisite, until the

(2) On the 28th of May, ult., the German Diet was petitioned for revoking the compulsory vaccination act on the ground that 26 girls vaccinated nearly all had taken syphilis. Louisville, Ky., Omnibus, June 2, 1878.

vaccination of the child is effected.¹ Further: Vaccinators have the right to take the lymph from any child,² and parents and guardians are required to bring the child to the vaccinator for inspection;³ in case of interference or noncompliance, a penalty is to be inflicted, for each offence, of 20 shillings.⁴ Again, from the actual cruel severity of this law, it must be seen that no person can escape vaccination and revaccination (acc. to provis. of sect. viii, p. 8) in England. It is also asserted that "cow-pox" affords, if not an absolute, yet a very great protection against an attack of small-pox, and an almost absolute protection against death from that disease,⁵ yet to crown the cruelty even with absurdity a fine of twenty pounds awaits any one who may have rented to others localities that may have been occupied by infected persons; or a fine of five pounds if any bedding, clothing, rags or other things of such person may be sold; moreover, a person suffering from "infectious disorder" must pay a fine of five pounds for entering a public conveyance,⁶ etc. The amount of money annually paid for vaccination by the people of England is about 300,000 pounds—(\$1,500,000 dollars).⁷

The compulsory vaccination act of the German empire is, in a great measure, modeled after those of England, only being still more tyrannical. Parents and guardians failing to have their children vaccinated and revaccinated, according to the provisions of §§ 1 and 2, are liable to a fine of 50 marks (12 dollars) and three days' imprisonment. Also, physicians and principals of schools failing to have vaccination properly recorded, may be fined 100 marks (24 dollars), and any one performing vaccination carelessly, is subject to a fine of 500 marks (120 dollars), or to imprisonment of three months, provided no severer punishment must follow, according to the penal law.⁸

In Sweden a fine of 3 Rix dollars follows a noncompliance with the vaccination law, but in Denmark an enforcement of compulsory vaccination is insisted on only when the child is admitted to school.⁹

(1) Vacc. Acts, secs. 31 and 32, p. 10.

(2) Sec. 17, p. 12.

(3) Ibid.

(4) Sec. 11, p. 20.

(5) Introduction, p. IX.

(6) Sec. 32, pp. 20-21, note.

(7) See *Controverse ueber die Impffrage*, p. 39.

(8) Friedberg, l. c., pp. 111-112.

(9) Ann. Rep., Philadelphia, 1872, pp. 94-95.

In the natural history of man there can scarcely be found on any other grounds such an abyss of contradiction as in those logics (?) upon which, with a grimace of Mephistophelian sophisms, the pretended legality of vaccination is based. In every point of view it has proved disastrous, and consequently no other verdict can scientifically and legitimately be rendered than its total condemnation. Yet with audacity they have ventured to designate those who do not hesitate to expose, in the interest of humanity, imposition and crime, the epithet of "the small but noisy party of anti-vaccinationists."¹ In the fervor of hereditary submissiveness, the exaltation even goes so far as to proclaim: "*We physicians must endeavor to see that no child can go to communion if it is not, in the age from 12 to 14 years, revaccinated.*"² An epitaph devoted to Jenner, by Nittinger, and evidently in a mood of sarcastic indignation, most aptly forms a deserved inscription, as a commemoration to posterity, to every one of those who, from motives of self-interest or blind faith, have contributed to establish compulsory vaccination. It reads: "*Homo vanus et levis, cerebro vacuus et temerarius, mente et judicio carens, scientiam profanasti, terram perdidisti, populum occidisti.*"³

Having ascertained, from the natural history of variola, that the "specific" and "infectious" nature of variola and its prophylaxis by means of "vaccination" and "disinfection" are but presumptive propositions, hence the actual preventive and ameliorating measures against this disease can only be found indicated by the nature of its causes, and to recognize the class of causes against which efforts at correction or enfeebling their influences are attainable by man, a synoptical recapitulation may here be given:

1. Cosmic causes, comprising wide ranges (in comparison to the normal—usual) of atmospheric surroundings, such as thermometric, barometric, electric and hygrometrical irregularities (fluctuations).

2. Telluric and domiciliary causes, comprising deleterious exhalations from the ground, damp, ill ventilated and thronged dwellings; gross neglect of personal police, and improper dieting; extensive exposures in the pursuits and vocations of life.

3. Causes that originate within the human organism—namely, morbid structural changes of those organs of secretion of which the uræmia (azoturia), the system's primary condition or the pre-

(1) London Lancet, June 3, 1877, p. 810.

(2) Becker-Laurich, l. c., p. 35.

(3) Rahn, l. c. p. 34.

disposition, results and the consecutive alterations of those organs that are compensative and vicarious in their actions.¹

It is now fully evident that the causes of variola are of but a physical nature and origin, there is consequently no other prophylaxis than to remove their existence and avoiding individuals to be exposed to them, or to mitigate the intensity of their reaction by promoting health in general, and thereby overcoming the *locus minoris resistentiæ*. Health authorities of large cities should, therefore, strictly enforce general cleanliness of thoroughfares and premises, and establish thorough drainage in watery and miry districts, particularly if thickly inhabited. They ought further to devise proper plans in the construction and location of buildings which are for general inhabitation, so as to provide for the necessary ventilation, and to enable each inhabitant to respire due proportions of air at all periods.²

The immediate compliance with measures thus indicated, may frequently be difficult, nay, for the time being, an impossibility. It is, therefore, of the greatest importance that cities of larger dimensions have open places and public parks, as thereby, in the greatest majority of instances, the only opportunity is afforded to exchange the loathsome atmosphere the proletariat usually breathes with a purer air. In the neglect of a requisite degree of personal police is to be recognized one of the chief sources of predisposition to eruptive disease, it behooves, nay, it is imperative upon authorities of extensive cities to establish numerous bathing places, readily accessible and available throughout all the season of the year. The importance of a strict and general observation of such hygienic measures may the more be appreciated by bearing in mind that, upon the surface of a human individual of ordinary volume, are 700,000 perspiratory pores, by which 33 ounces of nitrogenized (morbific) matter is eliminated in 24 hours, nearly equaling the quantity of urine voided in the same space of time,³ and, in particular, with the multitude the promotion of the function of the skin is actually disregarded, and the performance of

(1) By enlargement of the spleen a great proportion of uric acid is generated—Gorup. Besanez, l. c., p. 621—which cannot be removed by the morbidly altered kidneys.

(2) It is approximately calculated that from 400 to 600 cubic feet of air pass through the lungs daily, and that 23 cubic feet, of oxygen are thereby absorbed. (Vital capacity on the average maximum is 3,770 c.m.,—L. Hermann.) In the prison, Pentonville, from 1,800 to 2,700 cubic feet of fresh air pass into each cell per hour; and in the New King's College Hospital each patient has from 1,850 to 2,500 cubic feet (63.47x cubic met.) of air. (Todd & Bowman, l. c., p. 728.) The calculations made by Petterkufer: 60 cub. met. p. hour fully corresponds with this,—(Populäre Vorlesungen, Heft I, p. 13.

(3) Golding Bird, Urinary Deposits, p. 131.

its function gravely interfered with, owing to the nature of their pursuits and the general want of bathing facilities.

The adoption and enforcement of such essential sanitary measures cannot too urgently be insisted on.

Pursuant to the proposition made in the introductory remarks: to give a sketch of the treatment, some of the chief therapeutic hints may therefore here be intimated.

During the erethic or fibrile stage, or that of the "fibrinous, fermentative leucocytose-septicæmy," the stage in which the morbid elements are rapidly multiplied, and albuminous coagula form in the blood, which lead to the formation of thrombi or emboli in the smaller vessels that ramify in the cutis and result in the development of the papulæ variolosæ, or as the same process is apt to occur in the lungs, where the inflammation constitutes pneumonia variolosa, the free use of *calomel* is indicated. This remedy forms with albumen compounds that consist of chloride of albumen and mercury, and redissolve in solutions of chloride of sodium,¹ or in the serum of the blood. Compounds thus formed are not immediately destructive to life, and prior to their consequent solution they may have been conveniently conveyed to the excretories for elimination. In this manner calomel contributes to free the system from the material prone to augment the fermentative or septic decomposition of the blood, and which otherwise infiltrates the glands. The next important remedy, which readily suggests itself, is the *neutral hydorchlorate of quinine*.

This drug possesses unparalleled antifermentative and antiseptic properties, demonstrated by Binz² by direct experimentation. The process of putrefaction and the development of fungous growths is entirely prevented by it (not so by the employment of sulphate of quinine), and owing to the equivalent of muriatic acid which it contains, it is better borne by the stomach and is more readily absorbed. But one more remedy remains, which we deem indispensable, and which must be considered of cardinal importance, both as a remedy and prophylactic. In a theoretical and physiological sense, there can be no doubt of its therapeutic virtue. This remedy is *chloride of sodium*.

When considering the histochemistry of the variola process, it was learned that chloride of sodium was displaced, in a great

(1) Beck's Med. Jurisprudence, twelfth Ed., Vol. 2, p. 625.

[2] Virchow's Arch., Vol. XLVI, pp. 74 to 95. Also, comp. Grund-Zuege der Arzneimittellehre, 5th Edit., pp. 184 to 190.

measure, from the circulating fluid (blood and lymph), and heterogeneous substances had taken its place (uric acid, urate of soda and ammonia, etc.), that, consequently, oxygen readily converted the albuminous compounds into the products of septic fermentative decomposition, leading, ultimately, to decay and putrefaction; that, under the influence of chloride of sodium, the opposite takes place: instead of decay and putrefaction, formation of healthful protoplasmic forms, which can be readily appropriated in the animal economy.

In 1870 I had already urged its general use. Its mode of application, however, requires a radical modification if its reaction shall be immediate and potential. Hitherto it has been administered in the form of seltzer water, from one to two quarts daily, in private practice, and also as a lotion, mixed with albumen and olive oil, applied to the surface with a view to allay the itching, if possible to neutralize the formation of pus in the pustule, and to prevent pitting. Although the clinical evidence bears favorable testimony for its future and free use, yet its value is rather too limited to constitute the basis of a rule or therapeutical law.

In hospital practice, where facilities are sufficiently abundant and the hindrances of its rational mode of employment can readily be overcome, weak solutions of 3 to 4 per cent. of chloride of sodium, with a temperature elevated to that of the blood, perhaps, should be directly conveyed into the circulation, perhaps in the same manner as Cohnheim perfected his experiments on frogs, further above alluded to, and thus directly impregnating the blood with the salt; also to repeat the operation as frequently as the condition of the case may indicate, there can be no other issue than a salutary one. This suggestion is here the more readily submitted as it is hoped that in future, or at the earliest opportunities, the measure may be tested, that the clinical results will faithfully be recorded, and given to the profession in full.



CORRIGENDA.

Page 2, in 5th line from above, read "grössern."

" 4, in 19th line from above, erase "1874,"

" 9, in 28th line from above, read "ignorance."

" 16, in note 1, 4th line from above, read "Tombose."

" 19, in 8th line from above, read "Malpighian."

" 19, in 18th line from above, read "over a tube."

" 19, in note 1, first line, read "no urticaria, etc."

" 19, in note 1, third line, read "Malpighian."

" 32, in 19th line from above, read "thrombi."

" 32, in note 3, read "Dennis, and von der Horst."

" 32, in note 3, read "Hoppe-Seyler."

" 33, in note 1, 4th line, read "contained in the."

" 39, in 7th line from above, read "Malpighian."

" 49, in 9th line from above, read "conical."

" 50, in 7th line from above, read "Malpighian."

" 67, in 15th line from above, read "have further."

" 69, in 1st line above, insert comma after the words "salvation" and "argued;" and erase comma after the word "desired," in the third line.

" 71, in 24th line from above, insert "and" after the word "emboli."

Accession no.
ACK

Author
Spinzig, C.
Variola: its causes,
nature and prophy-
axis.
Call no. 1878.

INOCULATION
VACCINATION